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An Experimental Study of Decision Types and Their Mental Correlates

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AN EXPERIMENTAL STUDY OF DECISION TYPES AND THEIR MENTAL CORRELATES

It is a matter of common observation that individuals differ greatly in decision *time, accuracy,* and *constancy* of or consistency in subjective decisions. It is generally supposed that the slow in decision are both more constant and more accurate than the quick. "Slow but sure" is a popular maxim. The chief purpose of this investigation was to determine the actual nature of these various decision types—to see, for example, whether "quick but sure" and "slow but unreliable" are not equally true of certain classes. In other words, it was desired to ascertain the relation between decision *time* and *constancy,* between *time* and *accuracy,* and also between the subjective and objective decision types thus determined. A further purpose was to determine the correlation subsisting between these decision factors (viz.: time accuracy and constancy) and other mental traits such as memory, association time, suggestibility, attention, etc.

The experiments were conducted in the Harvard Laboratory during the years 1911 to 1913. In all, nineteen subjects took part; three of them (A, C and L) continued through the two years' work. Twelve participated in the first year's experiments reported in the first part of this paper, and ten in the second year's experiments reported in Chapter II. All were members of the laboratory and trained in experimental methods. Five (D, F, I, O, and P) were women. Three of these were in the first year's investigation and two in the second.

In the first year's experiments on decision the materials used were cards upon which were printed the names of the objects to be decided upon from various points of view. Of these there were forty pairs, fifty groups of three each, and fifty groups of five each.[1] The following are some representative examples.

[1] All the pairs, twenty-five groups of three and twenty-five groups of five were selected from material prepared by G. W. Peckham, who had begun work upon this problem in the Harvard Laboratory, but found it necessary to discontinue the investigation.

Pairs: violin music, piano music; Hamlet, Macbeth; orange marmalade, baked apple; Hume, Kant; gunpowder, printing; camel, elephant. Threes: Poe, Kipling, Hawthorne; wealth, strength, power; literature, science, philosophy; baseball, football, tennis; Dante, Goethe, Shakespeare; X-rays, photography, telegraphy; fountain pen, penknife, watch. Fives: music, sculpture, painting, drama, poetry; peaches, pears, apples, grapes, cherries; chrysanthemum, lily, dahlia, carnation, rose; Rembrandt, Holbein, Titian, Rubens, Ingres; temperance, wisdom, justice, courage, truth; bicycle, safety razor, automobile, telephone, balloon. The material used for subjective decision in the second part of the investigation, and that used for accuracy of decision, and in the several tests, will be described under the sections dealing with these various experiments.

RELATION OF TIME AND CONSTANCY

The first experiments performed were to determine the relation between time and constancy in relatively subjective decisions. These experiments can be divided into three series. In the first series, consisting of forty experiments, the pairs of cards, described above, were exposed by tilting back a shutter behind which they had been placed. The subject was directed to decide as quickly as was compatible with sincerity, and to raise the right or left hand according as the decision was for the right or left card. The basis of decision, which varied with the nature of the concepts, was in each case given by the experimenter; thus: decide according to your preference, their greatness, their importance, or their usefulness. The time was taken with a stop watch, which was started at the same instant that the crank of the shutter was turned back, and stopped at the signal of the subject. The time and the decision were recorded. After five weeks the experiment was repeated in the same way. The decision and time were again recorded and compared with those of the first presentation.

The results of this series of experiments are shown in Table I. The number of changed decisions, the average time for the

first presentation, the average time for the second presentation, the combined average, and the number of first decisions remembered at the second presentation, are given for each of the nine subjects. The number of decisions changed varies from 1 for subject F to 13 for subject G; and the decision time from 1.46″ for C to 3.30″ for H. There is, however, no evidence of a correlation between time and constancy. The figures in the last column give some idea of the part played by memory in this experiment.

TABLE I

		Results with Pairs			
Subject	*No. C.*	*A. T.*^{1}	*A. T.*^{2}	*A. T.*^{3}	*No. R.*
F	1	2.96	2.34	2.65	31
A	4(—1)	2.74	2.56	2.65	9
B	5(—2)	2.28	2.91	2.60	7
E	5	2.54	2.23	2.39	7
C	6(—1)	1.46	1.57	1.52	3
H	7	3.30	3.12	3.21	18
D	8(—1)	2.49	1.99	2.24	12
I	10(—1)	2.00	1.43	1.71	20
G	13(—3)	3.04	2.75	2.89	14

No. C. = Number of changed decisions. Those in brackets doubtful.
A. T.^{1} = Average for first presentation.
A. T.^{2} = Average for second presentation.
A. T.^{3} = Combined average.
No. R. = Number of decisions remembered from first to second presentation.

In order to eliminate the memory factor as far as possible, a more complex series of experiments was devised. This second series consisted of the fifty groups of three cards each. These were arranged by the subject *in order* of preference, greatness, importance, or usefulness. The method was otherwise the same as in Series I. The motor activity of arranging the cards was rendered approximately constant in the following manner: On tilting back the shutter the cards were exposed in an upright position between two slats. The subject removed each card and laid it down whether the presented arrangement was maintained or changed. This series was also repeated in four to five weeks, except in the case of subjects K, J and L; here the time between first and second presentation was seven to eight weeks The

same directions for arranging the cards were given the subject on each occasion; but a change of the basis of decision sometimes occurred under the category specially mentioned,—e.g., *importance* might mean importance to self, to the world, to science, etc. The possibility of such changes was as far as possible avoided; but all differences due to these changes or to lack of knowledge of the material were eliminated. The results of this series are shown in Table II. The number of changed decisions, and the average, and the median for the first and for the second presentations are given. Also, in columns marked "Above M^2" and "Below M^2", the changes in decisions whose times are above or below the median in the second presentation are given. There are always more changes in decisions above the median. This may be explained by supposing that the uncertain decisions take the longest time, and are also the more liable to change.

TABLE II

Results with Groups of Three

Subject	*No. C.*	*A.*^{1}	*M.*^{1}	*A.*^{2}	*M.*^{2}	*Above M*^{2}	*Below M*^{2}
A	11	8.7	8.2	9.5	9.3	9	2
K	16(—6)	6.3	5.6	10.1	7.3	12	4
J	17(—5)	7.1	6.2	5.7	5.0	15	2
D	16	5.8	5.5	5.5	4.8	9	7
F	17	7.8	6.8	6.8	5.6	12	5
E	18(—1)	7.3	7.1	6.5	6.3	10	8
B	20(—3)	9.6	9.0	8.3	7.6	13	7
C	21(—4)	9.5	8.4	6.5	5.4	13	8
L	25(—7)	16.4	13.5	12.3	11.1	16	9
H	28(—5)	11.0	10.2	8.1	7.9	19	9
G	27	8.9	8.6	8.3	7.8	17	10
I	32(—2)	4.3	4.2	4.9	4.4	18	14
				(Total).....		163	85
						66%	34%

No. C. = Number of changed decisions.
A.^{1} = Average for first presentation.
A.^{2} = Average for second presentation.
M.^{1} = Median for first presentation.
M.^{2} = Median for second presentation.
Above M^2 and Below M^2 = Number of changed decisions above and below the median in the second presentation.
In Brackets, doubtful decisions to be subtracted.

Table III-A shows how the subjects might be classified according to type. The types, however, grade into each other and some

subjects are difficult to place. The memory factor which vitiated the results of the first series (see table I) was almost negligible here, and entirely so in Series III, when the fifty groups of five cards each were presented and arranged as in Series II. These were also repeated in about five weeks and the results are summarized in Table IV in the same manner as in Table II. In Table III-B the subjects are classified according to type as a result of this series. For the most part they hold the same place as in III-A; but two subjects, E and F, are relegated from the constant to the inconstant class, probably confused by the greater complexity of the conditions. In the case of E, who was leaving the University, the second presentation for twenty-five of the fifty groups was given two weeks after the first instead of five. The number of changes would in all probability have been greater, had the time for him been the same as for the others. C, however, who is medium in time and constancy in III-A, takes comparatively very much longer to decide with groups of five; thus becoming slow in time and medium in constancy in III-B.

Subjects J, K and L are omitted in Table IV, because they were given only twenty-five groups of this series. Table V and III-C give the results of all the subjects for these twenty-five. On comparing Tables III-A and III-C it will be noticed that here again under the more complex conditions, one subject, K, is removed from the quick to the slow; and another, F, is removed from the quick constant to the slow inconstant. These were the twenty-five groups that were repeated with subject E in two weeks instead of five, and this probably accounts for his position in III-C as compared with III-B. It is worthy of notice that the slow subjects are on the whole more constant than the quick; but both slow and quick can be divided into constant and inconstant classes. The slow constant are, thus, more constant than the quick of the same class.

The classifications in Tables III-A, B and C were made more difficult by the fact that the medians of some subjects differ greatly from the averages. We have used the median as the basis of classification. This is quite satisfactory with subjects

whose decision time is uniform, for here there is a close correspondence between median and average; but sometimes when the decision time is variable the correspondence is not so close. The median is always less than the average, sometimes only slightly less, but in certain cases (e.g., that of K) very much less. This suggests another classification of the subjects, on the basis of the mean variation of their decision times, into the "Uniform" and the "Variable." The most variable would then be subjects K, C and F; and the most uniform, subjects A, G, B and E. It will be noted that the subjects who were removed from one class to another under more complex conditions, as mentioned above, are also variable subjects; and their variability in time and change of class may be results of the same factor. For under any given class some decisions are more difficult than others; and their general inability to cope with difficult situations prolongs the decision time or produces inconstancy, even in circumstances when less difficult decisions are quick and constant. In other words, there is a type of subject who, in simple situations (i.e., easy decisions), is very quick and constant; but who, when the decisions are more difficult, becomes relatively slower and more inconstant. This fact is of considerable significance in vocational guidance, and situations of practical life, for such subjects must be eliminated if a selection of *unfailingly* quick constant workers is to be made.

The method of estimating the amount of the change when a group of three or five was arranged in a different way on the second presentation needs some explanation. Not the absolute changes of position, but the relative changes were considered. Thus, in a group of five, A, B, C, D, and E, the greatest possible number of changes is ten. This would occur if it were completely inverted, E, D, C, B, A; for although C is in the same absolute position, yet A has changed relatively to B, C, D and E, B to C, D, and E, C to D and E, and D to E. In one group of five, then, any degree of difference from one to ten is possible, while in a group of three, the difference cannot exceed three.

TABLE III-A

Threes

Type	*Subject*	**No. C.*	*M.*[1]	*M.*[2]
Slow constant	A	11	8.2	9.3
	B	17	9.0	7.6
	H	23	10.2	7.9
Slow inconstant	G	27	8.6	7.8
	L	18	13.5	11.1
	C	17	8.4	5.4
	D	16	5.5	4.8
	E	17	7.1	6.3
Quick constant	J	12	6.2	5.0
	K	10	5.6	7.3
	F	17	6.8	5.6
Quick inconstant	I	30	4.2	4.8

*The doubtful ones, bracketed in Table II, have been subtracted.

TABLE IV

Results with Groups of Five (50)

Subject	**No. C.*	*A.*[1]	*M.*[1]	*A.*[2]	*M.*[2]	*Above M.*[2]	*Below M.*[2]
A	36	19.7	19.0	20.1	19.6	23	13
B	54	20.3	19.6	20.7	21.0	33	21
C	66	23.6	19.7	15.9	13.4	40	26
D	66	13.7	12.1	14.0	12.5	48	18
E	73	14.9	14.6	13.0	12.8	45	28
F	77	18.5	16.1	15.7	13.4	55	22
G	77	19.5	18.8	17.0	16.8	40	37
H	79	24.2	22.2	18.7	18.3	58	21
I	108	8.6	8.6	8.3	7.5	45	63
					(Total)	387	249
						61%	39%

*All doubtful ones have been subtracted.

TABLE III-B

Fives—50 Groups

Type	*Subject*	*No. C.*	*M.*[1]	*M.*[2]
	A	36	19.0	19.6
Slow constant	B	54	19.6	21.0
	C	66	19.7	13.4
Slow inconstant	H	79	22.2	18.3
	G	77	18.8	16.8
Quick constant	D	66	12.1	12.5
	F	77	16.1	13.4
Quick inconstant	E	73	14.6	12.8
	I	108	8.6	7.5

TABLE V

Results with Groups of Five (25)

Subject	*No. C.*	*A.*[1]	*M.*[1]	*A.*[2]	*M.*[2]	*Above M.*[2]	*Below M.*[2]
A	23*(6)	21.4	21.3	21.0	20.0	16	7
E	24 (9)	15.0	13.6	13.2	13.0	16	8
B	27 (8)	20.9	20.2	20.0	19.0	16	11
J	29 (5)	14.6	13.2	12.6	11.0	17	12
D	29 (9)	13.4	12.4	15.2	12.4	19	10
C	30(10)	19.1	17.0	11.6	12.0	16	14
K	31 (5)	32.4	22.4	34.3	27.6	21	10
H	36 (9)	23.1	22.2	18.1	17.2	26	10
G	35(11)	17.9	15.6	15.4	15.0	17	18
I	36 (9)	10.0	9.0	10.0	10.0	25	11
F	45 (5)	21.6	22.0	22.2	24.1	31	14
L	48 (4)	22.1	20.0	16.5	15.6	29	19
					(Total).....	249	144
						63%	37%

*In brackets are *additional doubtful* differences.

TABLE III-C

Fives—25 Groups

Type	*Subject*	*No. C.*	*A. M.*
Slow constant	A	23	20.2
	B	27	20.0
	K	31	25.0
Slow inconstant	H	36	19.3
	G	35	15.6
	F	45	23.2
	L	48	17.8
Quick constant	E	24	13.2
	J	29	12.1
	D	29	12.4
	C	30	14.5
Quick inconstant	I	36	9.5

A. M. = Average of M.[1] and M.[2]
No. C. = Changes, all doubtful ones subtracted.

It will be noticed that the time for the second presentation is generally less than for the first. In some cases (e.g., that of subject C) it is much less. This is what we would expect, but there are two striking exceptions: viz., subject K, whose time is much longer in the second case, and subject A. This lengthening of the time may be due to a more or less conscious effort on the part of these subjects to be constant. The decrease in time in the

case of C is very much more than one would expect; and for H and L considerably more than the average. Here we have a type of subject that, having once made a satisfactory decision, is able, when placed in a similar situation, to make a similar decision much quicker than the first. Such a subject learns from experience, and performs his customary decisions as it were automatically. So long as the situation remains the same he becomes more and more efficient. This, however, does not prove that he will be more efficient in *novel* situations. On the contrary, the latter sort of efficiency may very well be an original endowment, that no amount of training can develop. The time, therefore, for the first presentation is of greater significance in classifying the subjects than that for the second. Here again the existence of these two types of efficiency in decision has considerable bearing upon vocational guidance.

The mean average decision time was determined for pairs, for groups of three, and for groups of five. The columns marked A in Tables I, II, and V were added up; and the respective sums divided by the number of subjects in each case. The results are as follows:

Mean average time for pairs	2.54
Mean average time for threes	8.56
Mean average time for fives	19.30

The ratio of increase is greater from pairs to threes than from threes to fives (3.37 and 2.14 respectively). The subjects whose decision times vary most from the average are: I, whose time for groups of five is 8.6, and K, whose time for the same is 32.4. The former is a "Uniform" subject, the latter a "Variable" one; and there is, therefore, no correlation between variability of decision time for any particular subject and variability from the mean average of all the subjects. We are speaking of variability in time only, not in decision; and the above has, therefore, no bearing upon F. L. Wells' statement that "Those who vary the least from their own judgments also vary least from the judgments of others."[2]

[2] "On the Variability of Individual Judgments," Essays Phil. and Psych. in honor of William James, p. 529.

A noticeable feature in the second presentation of Series II and III was the numerous memory illusions. These occurred with every subject but with some more than others. The women were generally more subject to them than the men. In each case the subject was asked whether he rememberd having made the decision before, and if so whether he decided in the same way. In many cases the subject would vigorously affirm that he actually remembered arranging the cards in the same way before, when the previous arrangement was really quite different. There were also some fewer cases when the subject remembered that his decision was different, when it was really the same.

CONFIDENCE

Three of the subjects—J, K, and L—were asked to state the degree of their confidence in each decision. This was reported by the subjects as meaning either "The subjective feeling of satisfaction in the arrangement," or "The assurance of constancy." The same subject would alternate between these two attitudes from time to time. The subjective feeling is different in each case; but for our purposes, the correlation of constancy and confidence, we assume that they need not be distinguished; for the former always implies the latter, though the opposite is not always true. The degree of confidence was given as A, B, or C,—A being perfect confidence, C very little or none, and B medium. It is clear that the subjects might differ not only in the degree of their confidence but also in their way of describing it. The same degree of confidence might be described as A by one and as B or C by another. This, however, is a criticism that can be raised as well against the introspective method as a whole.

The results of this confidence test are shown in Tables VI-A and VI-B. The subjects are compared with one another; and the confidence of the decisions that were changed with that of the whole. The "numerical value" is obtained rather arbitrarily by valuing A at 2, B at 1, and C at 0; but perhaps it is not so arbitrary after all, for A is introspectively perfect confidence (1), B medium (½), and C none (0); and to avoid fractions 2, 1,

and o are used instead. The average confidence is obtained by dividing the numerical value by the number of decisions.

The following points are noteworthy:

(1) The more confident subjects are also the more constant.

(2) The confidence is slightly less with the decisions that were changed. (See Tables VI-A and VI-B under "Average Confidence.")

(3) One subject (J) is regularly less confident on the second presentation; the others are equally or more confident.

(4) The decisions changed are divided fairly equally among A, B, and C; but the amount of the change is as a rule greater in C decisions than in B's or A's. There are, however, exceptions. (See tables VI-A and VI-B, last section.)

TABLE VI-A—(THREES)

Subject	*No. D.*	*P.*¹	*P.*²	*N.V.*¹	*N.V.*²
		Degree of Confidence in Total Decisions			
J	49	32A + 10B + 7C	26A + 15B + 8C	74	67
K	49	28A + 13B + 8C	29A + 16B + 4C	69	74
L	50	14A + 25B + 11C	14A + 29B + 7C	53	57
		Degree of Confidence in Decisions Changed			
J	10	6A + 3B + 1C	2A + 6B + 2C	15	10
K	9	3A + 4B + 2C	4A + 4B + 1C	10	12
L	16	4A + 6B + 6C	4A + 8B + 4C	14	16

Average Confidence, if A is represented by 2

	Total Decisions		*Decisions Changed*	
	*P.*¹	*P.*²	*P.*¹	*P.*²
J	1.51	1.37	1.50	1.00
K	1.41	1.51	1.11	1.33
L	1.06	1.14	.87	1.00

Average Amount of Change for A, B, or C Confidence

	No. Groups Changed		*N. V. of Changes*		*Ave. for A, B, C*
J	10	6A 3B 1C	12	7A 3B 2C	1⅙ A 1 B 2 C
K	9	3A 4B 2C	10	3A 4B 3C	1 A 1 B 1½ C
L	16	4A 6B 6C	18	4A 6B 8C	1 A 1 B 1⅓ C

P.¹ and P.² = First and second presentations.
N. V.¹ and N. V.² = Numerical Value of confidence in first and second Decisions
No. D. = Number of Decisions.

TABLE VI-B (FIVES)

Degree of Confidence in Total Decisions

Subject	No. D.	$P.^1$	$P.^2$	$N.V.^1$	$N.V.^2$
J	25	14A + 6B + 5C	9A + 13B + 3C	34	31
K	25	10A + 12B + 3C	11A + 9B + 5C	32	31
L	25	3A + 14B + 8C	2A + 19B + 4C	20	23

Degree of Confidence in Decisions Changed

J	14	5A + 4B + 5C	2A + 10B + 2C	14	14
K	17	5A + 10B + 2C	7A + 5B + 5C	20	19
L	21	2A + 11B + 8C	1A + 16B + 4C	15	18

Average Confidence, if A is represented by 2

	Total Decisions		*Decisions Changed*	
	$P.^1$	$P.^2$	$P.^1$	$P.^2$
J	1.36	1.24	1.00	1.00
K	1.28	1.24	1.18	1.12
L	.80	.92	.71	.86

Average Amount of Change for A, B, or C Confidence

	No. Groups Changed		*N. V. of Changes*		*Ave. for A, B, C*
J	14	5A	29	6A	1⅕ A
		4B		11B	2¾ B
		5C		12C	2⅖ C
K	17	5A	31	6A	1⅕ A
		10B		23B	2 3/10B
		2C		2C	1 C
L	21	2A	48	8A	4 A
		11B		20B	1 9/11B
		8C		20C	2½ C

The degree of difficulty of the decisions was also obtained from the same three subjects, but only for the first presentation. The results are given in Tables VII-A and VII-B. D means difficult, M medium, and E easy. An arbitrary "numerical value" is obtained by valuing the difficulty of D at 2, of M at 1, and of E at O; and the average difficulty by dividing the numerical value by the number of decisions.

It will be noticed that:

(1) The subjects differ considerably in the amount of difficulty, and the least confident subject has the greatest difficulty in the threes, but the least in the fives.

(2) The easy as well as the difficult decisions are changed, but the average difficulty for those changed is slightly greater than for the total.

TABLE VII-A (THREES)

Subject	*No. D.*	*Degree of Dif.*	*N. V.*	*Ave. Dif.*
		Degree of Difficulty in Total Decisions		
J	49	15D + 12M + 22E	42	.86
K	49	10D + 16M + 23E	36	.73
L	50	22D + 7M + 21E	51	1.02
		Degree of Difficulty in Those Changed		
J	10	4D + 2M + 4E	10	1.00
K	9	3D + 1M + 5E	7	.77
L	16	7D + 3M + 6E	17	1.06

TABLE VII-B (FIVES)

		Degree of Difficulty in Total Decisions		
J	25	8D + 7M + 10E	23	.92
K	25	13D + 4M + 8E	30	1.20
L	25	6D + 7M + 12E	19	.76
		Degree of Difficulty in Those Changed		
J	14	7D + 5M + 2E	19	1.36
K	17	10D + 3M + 4E	23	1.35
L	21	5D + 6M + 10E	16	.76

ASSOCIATION

Two experiments were carried out to ascertain the association time of the subjects. There were nine subjects, six of whom were the same in each case and three different. In the first a list of fifty words were used. These were repeated to each subject who was directed to reply as quickly as possible with the first word that came to his mind. The time was taken with a stop watch visually; that is, the watch was started and position of the hand noted when the word was given, and when the reply was heard. This method was found difficult and inaccurate; and in the second experiment, which consisted of forty words, the watch was started when the word was given and stopped when the reply was heard. The results were very much the same except in the case of C, whose time in the second experiment is much shorter than in the first. Full results of both experiments are given in Table VIII.

TABLE VIII

	Association Time					Decision Time $A.^1$		Constancy No. C.		
Subject	$A.^1$	$M.^1$	$A.^2$	$M.^2$	T. S. C.	(3's)	(5's)	('3s)	(5's)	
B	1.880	1.8	1.465	1.4	41.4	9.6	20.3	17	*54	†27
H	1.436	1.4	.....	...	....	11.0	24.2	23	79	36
F	1.416	1.4	1.387	1.4	32.4	7.8	18.5	17	77	45
G	1.348	1.4	.....	...	....	8.9	19.5	27	77	35
I	1.108	1.0	1.332	1.3	26.0	4.3	8.6	30	108	36
J	.....	...	1.147	1.2	35.2	7.1	14.6	12	..	29
K	.....	...	1.130	1.1	23.2	6.3	32.4	10	..	31
L	.....	...	1.100	1.1	32.0	16.4	22.1	18	..	48
C	1.820	1.8	1.057	1.0	27.6	9.5	23.6	17	66	30
A	1.092	1.0	1.040	1.0	34.0	8.7	19.7	11	36	23
E	1.068	1.0	.....	...	....	7.3	14.9	17	73	24
D	1.056	1.0	.987	1.0	32.6	5.8	13.7	16	66	29

$A.^1$ = Average association time in first experiment.
$A.^2$ = Average association time in second experiment.
$M._1$ = Median for first experiment.
$M.^2$ = Median for second experiment.
T. S. C. = Time for sorting cards.
$A.^1$ = Average decision time for first presentation.
No. C. = Number of changes.
* = For fifty groups of fives.
† = For twenty-five groups of fives.

The amount of the correlation between association time and decision and constancy time may be brought out by the "Method of Unlike Signs." This method is recommended by Whipple only for preliminary survey and not for "final determinations of important correlations, because the probable error is too large."[3] It seems, however, sufficient for our immediate purpose.

The central tendency (median) of the association times of the twelve subjects is obtained, using the times of column 4 except for the subjects not represented therein. In Table VIII-A the subjects are arranged in the same order as in Table VIII, and their deviations above (+) or below (—) the central tendency (1.15) recorded. A similar procedure is followed for the decision time with threes (column 6) and with fives (column 8). By comparing each subject's deviation from the central tendency in decision time for threes with his deviation from the central tendency in association time (see Table VIII-A) it will be found that there are 50% cases of unlike signs; but a similar comparison in the case of decision time for fives gives 66 ⅔% cases of unlike signs. Now if we refer to Whipple's Manual, Table 9, we see that this means a correlation coefficient of 0 and —.509. The

[3] G. M. Whipple, Manual of Physical and Mental tests, p. 40.

number of cases investigated is probably too small to warrant any inference from these figures.

There is some evidence of a considerable correlation between association time and constancy. If we compare the deviation from the central tendency in the number of changes with the deviation in association time, we get for threes 17% cases of unlike signs, for fives 33 ⅓%. By reference to the Table in Whipple's Manual, we see that this signifies correlations of +.860 and +.509. It is scarcely probable that mere chance could give us these figures; and, though investigations on a larger number of subjects may alter them considerably, it is very likely that here we have evidence of a real correlation. We are, therefore, if we use the results of this very inadequate investigation, able to say that if a subject's association time is longer than the average, he is very liable to be more inconstant than the average; and similarly, that if his association time is shorter than the average, he is probably more constant; but in either case we can say nothing regarding the length of his decision time.

TABLE VIII-A

Subject	*D.A.*	*D.D.*^{3}	*D.D.*^{5}	*D.C.*^{3}	*D.C.*^{5}
B	+ .25	+ 1.3	+ .7	0	− 3½
H	+ .25	+ 2.7	+ 4.6	+ 6	+ 5½
F	+ .25	− .5	− 1.1	0	+ 14½
G	+ .25	+ .6	− .1	+ 10	+ 4½
I	+ .15	− 4.0	− 11.0	+ 13	+ 5½
J	+ .05	− 1.2	− 5.0	− 5	− 1½
K	− .05	− 2.0	+ 12.8	− 7	+ ½
L	− .05	+ 8.1	+ 2.5	+ 1	+ 17½
C	− .15	+ 1.2	+ 4.0	0	− ½
A	− .15	+ .4	+ .1	− 6	− 7½
E	− .15	− 1.0	− 4.7	0	− 6½
D	− .15	− 2.5	− 5.9	− 1	− 1½
		50%	66 ⅔%	16 ⅔%	33 ⅓%

D. A. = Deviation from central tendency (1.15) in association time.
D. D.^{3} = " " " " (8. 3) " decision time (3's).
D. D.^{5} = " " " " (19.6) " " " (5's).
D. C.^{3} = " " " " (17) " constancy (with 3's).
D. C.^{5} = " " " " (30½) " " (" 5's).

Numbers at foot of columns are percentages of unlike signs, by comparing with column 1.

SORTING CARDS

An experiment to test the rapidity of sorting cards was also performed. At first ordinary playing cards were used; but, since some of the subjects were more familiar with these than others, another pack of cards equally unfamiliar to all was substituted. This pack contained fifty-two cards, thirteen of which were marked A, and an equal number B, C, and D. The subject was told to sort them into four heaps according to the letters; and the time was taken with a stop watch. The results are shown in Table VIII, under column T. S. C. If the method of unlike signs be employed, as with association time above, to determine the correlation between time for sorting cards and decision time, it will be found that there are just 50% cases of unlike signs, and, therefore, the coefficient of correlation is zero.

MEMORY

Two sets of experiments were performed to test the memory of the subjects. The first was for immediate memory, and the second for memory over longer periods of time. In the former, nonsense syllables, words and figures were used. There were two tests with nonsense syllables. The first was to get the subject's memory limit; that is, the greatest number of syllables that could be remembered and repeated in order after two repetitions. The metronome was set to beat at one per second, and a syllable was exposed through a slot in a cardboard at each beat. Each list was given twice and the subject read the syllables aloud. After a five-second pause, the subject was asked to repeat the syllables in order. Four syllables were given in the first list; and if these were remembered, five were given, etc. In Table IX, column L.[1] shows the various limits. There is very little variation here, the limit being always four or five. Another test was therefore given. A list of nine syllables was exposed twice in precisely the same manner; and after five seconds the subject was asked to repeat all he could remember. The variations in this test were greater (from three to seven), as is shown by column "9," Table IX.

Two similar tests were made with words; one to ascertain the

limit, the other to get the number remembered out of a list of fourteen. The method was the same as with the nonsense syllables, and the results are shown in columns L.[2] and "14," Table IX. The limit varies from five to nine, and the number remembered out of fourteen, from eight to fourteen.

Memory for figures was tested by exposing numbers of six digits and upwards. The subject read the digits aloud at the beat of the metronome (one per second). The number was read through in this way twice, and then after a five-second interval it was repeated from memory. If the subject was successful, a number of one more digit was given, etc., until the limit was reached. The results varied from eight to eleven, as shown in column F, Table IX. The "Total" memory ability of each subject is obtained by adding the results of these five tests; and the subjects are arranged in order according to this sum. The decision type of each subject is indicated by the letters opposite the general memory index. More accurate information regarding time and constancy can be obtained in Tables II, IV or VIII.

If we again apply the "Method of unlike signs" to ascertain the amount of the correlations between the general memory index and decision time, and also between the former and constancy, we get in each instance 50% cases of unlike signs, and, therefore, a correlation of zero. Further, if the memory for nonsense sylla-

TABLE IX

	Nonsense Syl.		*Immediate Memory* *Words*		*Figures*		*Decision*
Subject	*L.*[1]	*9.*	*L.*[2]	*14.*	*F.*	*Total*	*Type*
F	4	3	7	8	8	30	S — I *
J	4	3	6	9	8	30	Q — C
G	5	4	6	9	8	32	S — I
A	4	5	5	10	10	34	S — C
B	5	3	6	14	9	37	S — C
I	4	7	5	13	10	39	Q — I
C	5	4	8	11	11	39	†Sor Q — C
K	4	4	8	14	10	40	†Sor Q — C
D	5	6	9	11	10	41	Q — C
L	5	7	9	14	9	44	S — I

S = slow.
Q = quick.
I = inconstant.
C = constant.
* = Q — C with threes.
† = Slow with fives.

bles, for words, and for figures be taken separately, we get in all *three cases* a coefficient of zero between memory and *decision time;* but a coefficient of .587 between memory for words and *constancy* in decision; and of .809 between memory span for figures after five seconds and *constancy.* That is, if we compare each subject's deviation from the central tendency for constancy with his deviation from the central tendency for memory for figures, we find that there are 80% cases of unlike signs. By referring to Whipple's Manual, Table 9, we see that this means a coefficient of correlation of —.809; but since + in the case of memory for figures signifies excellence, and in the case of number of differences, inconstancy, the relation between good memory and constancy is a direct (+) relation and not an inverse one. That is, the constant subjects have better memories for figures; and the same is true of memory for words.

Memory for a period of one week was also tested. Two lists of nonsense syllables of ten syllables each and one list of twelve words were given. The Lipmann-Marx memory apparatus[4] was used, and the number of repetitions necessary to learn each list recorded. The same list was given one week later and the saving in repetitions noted. The learning was called complete when the subject could anticipate one word or syllable ahead throughout the list. Learning ability or immediate memory is shown by the number of repetitions necessary to complete the learning, and memory for one week is represented by the percentage of saving. The results are scarcely reliable, especially for the words, as only one list was given; but they are presented in Table X and can be taken for what they are worth. The average of the two lists of nonsense syllables is taken and the percentage gained is calculated. The subjects are arranged (X-A) in order of the saving for the nonsense syllables; but no definite relation is shown to time and constancy which are indicated in the last column. If, however, they are arranged according to the saving for words (X-B), the slow appear to have poorer memories than the quick. There was some appearance of a similar relation in the case of immediate memory; but an application of the "Method

[4] See Bericht Über den VI Kongress für experimentelle Psychologie, p. 308.

of Unlike Signs" failed to reveal it. The same method now brings out a correlation coefficient of .92 between quickness in decision and memory for a period of one week; but it shows no correlation of memory for words with constancy; and in the case of nonsense syllables, no correlation of memory for one week with either constancy or time of decision. There are large individual differences in the number of repetitions necessary to learn the lists. These might be considered with Table IX as another test of immediate memory. No definite correlation is, however, brought out between the learning of either nonsense syllables or words, and decision time and constancy.

TABLE X-A

	Memory for One Week						
	Nonsense Syl.			*Words*			
Subject	*R.*[1]	*R.*[2]	*% Gained*	*R.*[1]	*R.*[2]	*% Gained*	*Decision Type*
J	12	10	17	11	6	45	Q—C
L	6½	5	23	10	6	40	S—I
A	10½	7	33	7	7	0	S—C
I	8½	5	41	4	2	50	Q—I
B	10½	6	43	8	5	38½	S—C
K	14½	7	52	7	5	28	S—C (or Q—C)
C	12	5½	54	8	4	50	Q—C (or S—C)
F	25	7½	70	6	3	50	S—I (or Q—C)

TABLE X-B

	% Gained on Words	*Decision Type*
A	0	S—C
K	28	S—C (or Q—C)
B	38½	S—C
L	40	S—I
J	45	Q—C
C	50	Q—C (or S—C)
I	50	Q—I
F	50	Q—C (or S—I)

R.[1] = Repetitions required for the first learning.
R.[2] = Repetitions required for the second learning.

ACCURACY OF DECISION

The foregoing experiments on decision dealt with the constancy of the subjects in subjective judgments, but no question of accuracy was involved. It, therefore, seemed advisable to perform some experiment to test the accuracy of decision. It proved however, very difficult to devise an experiment that would test accuracy

of decision, and that would not at the same time involve a test of sensory acuity. The following method, which is not free from various objections, was adopted. Black paper cards, in which different numbers of small holes were made, were exposed two at a time by means of a drop apparatus, and the subject was asked to point as quickly as possible to the one having the greater number of holes, or to raise both hands if he considered them the same. Two cards (A and B) with twenty-five holes in each were used as standards; and the other cards, containing from twenty to thirty holes each, were exposed successively with one or the other of these. The standard was placed now on the right side, now on the left; and the apparatus was so placed that when the slide dropped and the cards were exposed, the light shone through the holes from a window in the rear. The time was taken with a stop watch, and fifty decisions in all were obtained. The results are shown in Table XI under A.

It might have been expected that the subjects would fall into four classes; viz., slow accurate, slow inaccurate, quick accurate, and quick inaccurate; and that these would correspond to the four types of subjective decision. As is shown by Table XI, the latter is not altogether true. The types in subjective and objective decision are indicated by the letters in juxtaposed columns. The quickness of the objective decision is based upon the median rather than the average, as the latter was sometimes greatly increased by a few unduly prolonged decisions.

The difference in the number of errors are, however, scarcely sufficient to justify a classification into accurate and inaccurate. Fifty more decisions were, therefore, obtained. In this case the cards used as standards contained fifty holes each, and the other cards from forty-four to fifty-five. An attempt was made to have the holes cover nearly equal group-areas on the cards. The method of procedure was the same as before. The results are shown in Table XI under B. There is even less correspondence here between the subjective and objective types; e.g., subject I, who is quick and inconstant in subjective decisions, is slow and accurate in objective, and A, who is slow and constant in the former, is quick and inaccurate in the latter, etc.

TABLE XI

Subject	E.	A.	M.	Type in Obj. Dec.	Type in Subj. Dec.
			A—Fifty Easy Decisions		
D	13	1.50	1.4	Q—A	Q—C
C	13	1.56	1.4	Q—A	Q or S—C
A	13	1.98	1.8	S—A	S—C
I	14	2.07	1.6	Q—I or A	Q—I
F	15	1.78	1.6	Q—I	S—I (or Q—C)
B	16	2.76	2.2	S—I	S—C
			B—Fifty Difficult Decisions		
I	16	3.8	3.6	S—A	Q—I
F	18	2.5	2.5	Q—A	S—I (or Q—C)
C	19	3.4	2.7	Q—A	Q—C
A	23	2.3	2.0	Q—I	S—C
B	24	5.7	4.3	S—I	S—C
			C—Twenty-five Difficult Decisions		
K	7	7.7	4.3	S—A	S—C (or Q—C)
J	9	4.0	3.6	S—A or I	Q—C
L	10	3.8	3.0	S—A or I	S—I

D—Twenty-five Dif. Decisions—All Subjects

Subject	E.	A.	M.	Type in Obj. Dec.	Type in Subj. Dec.
K	7	7.7	4.3	S—A	Q—C (or S—C)
I	8	3.8	3.6	S—A	Q—I
J	9	4.0	3.6	S—A	Q—C
C	10	3.4	2.7	Q—A or I	Q—C (or S—C)
L	10	3.8	3.0	S—A or I	S—I
F	11	2.5	2.5	Q—I	S—I (or Q—C)
B	11	5.7	4.3	S—I	S—C
A	14	2.3	2.0	Q—I	S—C

E. = errors. Q = quick. S = slow.
A. = average time. C = constant. A = accurate.
M. = median. I = inconstant, or inaccurate.

Twenty-five of the difficult decisions were given to subjects K, L, and J, and the results are shown in Table XI-C. The times for all the subjects and the number of errors for the same twenty-five cards as were presented to these three are given in Table XI-D. An interesting result comes to light here; but it is also noticeable, though somewhat less evident, in the other Tables. It appears that *all those who were quick in subjective decisions are accurate in objective decisions, and the slow in subjective decisions are inaccurate in objective.*

This is a rather interesting correlation; but on second thought it is not so extraordinary as it at first seems. The individual who can narrow down his field of consciousness upon one problem or situation, and who can keep his attention from associated ideas,

will be quick in what we have been calling subjective decisions, for these are very rich in attractive associations. It is not surprising that such a mind will also be *accurate* in objective decisions, especially the kind we have required,—for here suggestibility and liability to illusions are prominent factors in producing error. It is very probable that suggestibility is the basis of this correlation, and that the suggestible person will be inaccurate in objective decisions as well as slow in subjective decisions of the kind we have been using here. In the second part of this paper it is shown that subjects quick in aesthetic decisions (Q and K) may also be very suggestible.

Those who were quick in subjective decision are not, as might be expected, always quick in objective. Indeed, the opposite seems true; for, taking the objective decisions by themselves, the accurate subjects are as a rule slow.

Their time, however, varies considerably, and this is the important result from the practical point of view; for it shows that in the same situation, there are some subjects who can decide both more quickly and more accurately than others. We have all along been speaking of Decision Types; but it must be clear to anyone who examines the figures that there are really no separate and distinct types into which each individual must fall; but that the types, so-called, grade into each other. It is often difficult to classify a subject according to type, because he is intermediate; and if the experiment were performed upon a larger number of subjects all the apparent gaps would no doubt be filled up. When we speak of types we are doing so merely for convenience sake, and not with the intention of adopting a "Multimodel Theory."

In all probability, this test was complicated by various spatial illusions, and illusions in the estimation of number. C. T. Burnet, in his study of the "Estimation of Number,"[5] has pointed out the tendency of some subjects to over-estimate compact groups, and of others to over-estimate scattered groups. In the second series of decisions in our experiment, the group-areas are all the same. Hence the holes would be closer together in

[5] Harvard Psych. Studies, Vol. 2, 1906, pp. 349-404.

some than in others; and this was also true of the first series, though no attempt was made to have the group-areas the same.

Another illusion that tended to produce a constant error until corrected was as follows: When the holes were farther apart, it produced the illusion that the group-area was larger. The apparently larger group was then pointed to as having more holes, when in reality it was the same size and had less holes. This was pointed out by one of the subjects after it had been the cause of several errors in his own case. Afterwards it was noticed with other subjects.

If all the subjects knew of all the possible illusions, then the estimation of the amount of the illusion might still be regarded as an objective decision. But in this particular case some subjects knew more of the illusions involved than others. We, therefore, conclude that the liability of the subject to illusion was involved, perhaps as the most important factor. If this is true, then the above result would be stated thus: Those who are quick in subjective decisions are less liable to illusion; that is, less suggestible, as we have noted above.

CONFIDENCE

The confidence of the subject, whether A, B, or C, was ascertained for each decision, as in the subjective decisions reported above. Confidence in this case means "Degree of certainty that the judgment is correct." The "numerical value" and "average confidence" were ascertained as before. The results of this confidence test are summarized in Tables XII-A and XII-B. It will be noticed that the confidence of the subjects varies greatly; and that *the confident subject is, on the whole, not more apt to be correct than the inconfident one.* In fact, subjects F and I, who have the least average confidence, have the fewest errors in the fifty difficult decisions. On the other hand *the confident judgment of any given subject is more apt to be correct than that inconfident one,*—as is shown by a comparison of columns A. C. and A. C. E. There are great individual differences in this respect, some subjects having more confidence in erroneous judg-

ments as compared with the total, than others: e.g., differences between A. C. and A. C. E. for C and K are small, while for J it is very large. The results here are slightly different from what we obtained for subjective decisions; but they possess greater reliability, because obtained from a greater number of subjects. Of course, both may be correct; that is, confidence may be correlated with consistency in subjective decisions; and at the same time show no correlation with accuracy in objective ones.

TABLE XII-A

First Series of Decisions—Easy

Subject	*N. E.*	*T. C.*	*A. C.*	*A. C. E.*
C	13	85	1.70	1.38
A	13	59	1.18	.92
D	13	54	1.08	.23
B	16	39	.78	.50
I	14	24	.48	.29
F	15	22	.44	0.

XII-B

Second Series of Decisions—Difficult

50 Dec.	C	19	73	1.46	1.16
	A	23	35	.70	.39
	B	24	17	.34	.17
	I	16	13	.26	.13
	F	18	5	.10	0.
25 Dec.	J	9	26	1.04	.11
	K	7	19	.76	.71
	L	10	15	.60	.30

N. E. = Number of errors.
T. C. = Total confidence—"numerical value."
A. C. = Average confidence.
A. C. E. = Average confidence for errors.

A comparison of the figures shows that no correlation between time in objective decisions, and association time or time for sorting cards is brought to light. Neither does there seem to be any correlation between memory ability and time; but a good memory is generally associated with accuracy. This is shown in Table XIII. It is also what we would expect; for we have seen that quickness in subjective decision is correlated with accuracy in objective decision and also with good memory.

TABLE XIII

Subject	*General Memory Index*	*Obj. Dec. Type*
F	30	Q — I
J	30	S — A
A	34	Q — I
B	37	S — I
I	39	S — A
C	39	Q — A (or I)
K	40	S — A
L	44	S — A (or I)

CHAPTER II

RELATION OF TIME CONSTANCY AND SUGGESTIBILITY IN AESTHETIC DECISIONS

The investigation was continued partly to verify the results already obtained, but chiefly to study the effect of suggestion upon decision time and constancy, and the correlation of suggestibility with these factors. Ten subjects participated in the investigation; and three of these, A, C, and L, had also taken part in the last. The same apparatus was used and the same method followed as in the previous experiment, except that this time only groups of five were used and instead of arranging them in order of preference the subject selected only the best and worst of the group.

In the previous investigation the names of the things to be decided upon were printed upon cards and exposed to the subject; this time the actual objects were used. These were: fifteen groups of colors, fifteen of color combinations, twenty of geometrical figures, twenty of pictures (reproductions of famous paintings), twenty of picture postal cards, and only the last ten of words as in the first experiment. In all one hundred decisions were obtained and these were, all except three or four in the last ten, aesthetic decisions. The subject was asked to place the best of the group on his left, the worst on his right. The five members of each group were arranged for each subject in the same way. They were marked A, B, C, D, E, and presented in this order from the subject's right to his left. The decisions for best and worst were recorded, and we were thus able to calculate the influence of position upon the subject's decision. In doing this we were obliged to omit the results for the first fifteen groups of colors and for five groups of geometrical figures, because for them the order of presentation was not recorded. The results for the remaining eighty decisions are given in Table XIV. Under the column marked "Pleasant" are given the number of times A, B, C, D, and E cards were chosen

as best by each subject; under the column marked "Unpleasant," the number of times each card was chosen as worst by each subject; and under the column marked "Total," the number of times each card was chosen either as best or worst by each subject. The totals for all the subjects in these three columns are given in the horizontal "Total" line at the foot. By referring to the total for the "Totals" column, it will be seen that B (that is, one card from the subject's right) had the preference for position, being chosen 351 times; while A (the extreme right card) was chosen least often, 308 times; but there is much less difference here than one would expect. The C, D, and E cards were chosen 314, 313, and 314 times respectively.

If we now turn to the totals for the "Pleasant" and "Unpleasant" columns, we find evidence of a pronounced tendency to choose the cards towards the E end of the line as pleasant, and towards the A end as unpleasant; e.g., E was chosen 183 times as pleasant, 131 as unpleasant; while A, on the other hand, was chosen 162 times as unpleasant, 146 as pleasant; and B 192 times as unpleasant and 159 times as pleasant. It will be remembered that E was always on the subject's left and A on his right, and that the instructions were: "Place the best card on your left and the worst on your right." We have here, therefore, evidence of an *inertia* or tendency to leave things as they are. This inertia varies greatly with different subjects. In the table we have arranged them roughly according to its amount, which is determined by the sum of the differences between the number of times A and E were chosen as pleasant, and also as unpleasant.

TABLE XIV

	Pleasant					*Unpleasant*					*Totals*				
Subject	*A*	*B*	*C*	*D*	*E*	*A*	*B*	*C*	*D*	*E*	*A*	*B*	*C*	*D*	*E*
O	14	14	18	11	23	16	17	17	19	11	30	31	35	30	34
R	12	18	11	16	23	16	19	15	17	13	28	37	26	33	36
C	11	13	22	18	16	18	16	13	20	13	29	29	35	38	29
N	14	15	16	18	17	18	20	11	17	14	32	35	27	35	31
A	14	18	15	20	13	20	17	14	17	12	34	34	29	37	25
Q	14	15	18	14	19	18	22	13	10	17	32	37	31	24	36
P	15	16	20	8	21	15	16	18	16	15	30	32	38	24	36
S	19	18	11	13	19	14	22	16	17	11	33	40	27	30	30
M	18	14	15	14	19	16	21	10	17	16	34	35	25	31	35
L	15	18	18	16	13	11	22	23	15	9	26	40	41	31	22
Total	146	159	164	148	183	162	192	150	165	131	308	351	314	313	314

It would seem, then, that the influence of position alone, judging from the totals for all subjects, is almost a negligible factor in this experiment. To be sure, B was chosen thirty-seven times oftener than any other card; but this predominance is almost entirely accounted for by its greater frequency in the "Unpleasant" group, where it appears twenty-seven times oftener than any other card. The influence of position *plus* instruction to place the best on the left and the worst on the right is, however, very marked, and, as we have pointed out, more noticeable with some subjects than others. This influence of position plus instruction may perhaps be explained in terms of suggestibility. If so, the most suggestible subjects would be most susceptible to it. This, however, does not seem to be the case; for a later arrangement of the subjects according to suggestibility does not follow the one given here. It may be, of course, that the later arrangement is at fault; but, on the whole, it would seem better to consider this result due to a tendency more pronounced in some subjects than others to leave things as they are when a decision would be difficult.

The influence of position alone, which may truly be called suggestion, also varies greatly with different subjects. This difference is brought out by a comparison of the figures for the various subjects in the "Totals" columns. In the case of each subject, the position least often chosen is subtracted from that most often chosen. The difference is taken as a numerical value of the influence of position, and in Table XV the subjects are arranged according to its amount. There seems to be an inverse correlation between suggestibility for position and the inertia discussed above; for in Table XIV, the subjects were arranged according to this inertia from the greatest to the least; here they are arranged from the least suggestibility for position to the greatest, and their relative positions are only slightly changed. This adds weight to the view that the influence of position plus instruction is not due to suggestibility, but to what we have termed inertia. The arrangement according to suggestibility for position does not, however, correspond to that later obtained

for suggestibility. This lack of correlation may arise because either one or both of the experiments are inadequate as tests for suggestibility. It is, of course, in perfect harmony with the view that there is no *general suggestibility,* but only varying *degrees of suggestibility* for different things.

In Table XV, column D, are given the differences referred to above; in column M, the position of the card most often chosen; and in column L, the position of the card least often chosen. It will be noted that the subjects differ considerably as to the position which attracts them most and least. Five of the subjects find B the most attractive position; three, C; and two, D. It is remarkable that neither A nor E, the two end cards, find a place. They occupy a mediocre position; for E occurs only twice and A once in the "least frequent" column. In the latter column, C occurs five times, each time being the least attractive position to a subject who found B the most attractive. B occurs in the L column not at all; and this position, that is, one from the right, has, therefore, the greatest attraction for the attention. If the instructions had been merely "select the best and worst" instead of "place the best and worst at your left and right," the attractiveness of the various positions might have been different; for the words "left" and "right" may have produced some effect upon the attention of the subjects.

TABLE XV

Subject	*D.*	*M.*	*L.*
O	5	C	A, D
N	8	B, D	C
C	9	D	=
M	10	B, E	C
R	11	B	C
A	12	D	E
Q	13	B	D
S	13	B	C
P	14	C	D
L	19	C	E

D = Difference between the number of Decisions for the card most often chosen, and the number for the card least often chosen.
M = Position most often chosen.
L = Position least often chosen.

Each of these hundred groups was presented to each subject for a second decision, after a period of six to eight weeks. Fifty

of them were presented in precisely the same manner as at first. The other fifty were presented each time with a suggestion to the subject to choose certain cards. The number of times that each card was chosen as best or worst in the first presentation was ascertained for each of the hundred groups. Sometimes the same card was chosen as best or worst by almost all of the ten subjects; e.g., colors, group 4, pleasant: 7A, 0B, 2C, 0D, 1E; unpleasant: 2A, 0B, 1C, 0D, 7E. This means that seven subjects chose A as pleasant; none, B; two, C; none, D; one, E; and similarly for the unpleasant. In other groups, a card that was chosen best by several subjects, was chosen worst by the rest; e.g., pictures, group 18, pleasant: 2A, 4B, 3C, 0D, 1E; unpleasant: 1A, 5B, 1C, 2D, 1E. In many groups, however, there was a much greater division of opinion; e.g., post cards, group 8, pleasant: 1A, 3B, 0C, 6D, 0E; unpleasant: 4A, 1B, 1C, 0D, 4E. Groups of the last kind were as far as possible, selected for "suggestion groups." These groups were presented at various intervals between "non-suggestion groups," sometimes alternately and sometimes two or three of one kind successively and then one of the other. With the non-suggestion groups the instruction was as in the first presentation: "Place the best on your left, the worst on your right"; but with the suggestion groups the following was always added: "The card most often chosen best is at your left, that most often chosen worst on your right." That is, it was explained to the subject that in certain groups the cards as presented to him would be arranged in a special order, so that the card chosen best by the majority of the ten subjects would be presented to him at the left, the worst on his right. This constituted a suggestion to the subject to leave the cards as they were, but he was left free to make a change if he so desired. This suggestion was adopted because it seemed to be one that could be used continually throughout the investigation, while its effect would remain practically undiminished.

The cards actually placed on the left and right in the suggestion groups were sometimes those chosen best and worst by the majority, sometimes not; e.g. ,in the illustration of a suggestion

group above, if a subject had previously chosen B as the best and E as the worst, he would be given D as the best and A as the worst; that is, a card that was really chosen the majority of times as best, on the left; and a tie for majority choice, on the right. If, however, the subject, himself, belonged to the class constituting the majority (that is, if he had chosen D as the best and A as the worst), he would be given B and E or C. The main object was never to place on the left and right the cards previously chosen by the subject himself as best and worst; the latter cards were always placed in positions B and D respectively. Thus, whenever the subject accepted the suggestion, he would have to change his previous decision to do so. We were thus able to calculate the effect of the suggestion, by comparing the number of changes in each subject's decisions for the fifty "non-suggestion groups" with his number of changes for the fifty "suggestion groups."

In Table XVI, the results are given for the fifty non-suggestion groups. The subjects are arranged according to the average decision time for the first presentation of the whole hundred groups. The average time for the second presentation of the fifty non-suggestion groups, and the number of decision changes in these groups are also given. In columns "a" and "d" are the number of changes in decision upon agreeable and disagreeable cards respectively. The "total" number of changes in the former is about the same as in the latter; but the individual subjects vary considerably. Subject R, e.g., has seven more changes in the "d" column, while Q and S have each nine more changes in the "a" column. This difference probably depends upon the amount of feeling produced by the agreeable or disagreeable cards. If the former tended to attract the attention more than the latter, there would be more differences in the choice of the latter, and vice versa. On the whole, the disagreeable cards were found by the subjects more unpleasant than the agreeable were pleasant, and thus the greater total number of differences in the "a" column is accounted for; but, as has been noted, there are marked individual differences here.

Turning now to a comparison of the total number of changes, we find that they range from 21 to 43. We have, then, as before, a constant and an inconstant class; but it is even more difficult here than in the previous investigation to draw any dividing line between these two classes. They grade into each other through a series of very small differences. The same is true of rapidity of decision. We get in column A. T.[1] a very great range of decision time—from 9.1″ to 32.8″; yet it is difficult to draw a line separating the quick from the slow. There is a fairly large middle gap between C (14.6″) and P (17.0″); but with a larger number of subjects all gaps would probably disappear; and the dividing line between the fast and the slow would be purely arbitrary.

TABLE XVI

Subject	*A. T.*[1] (*100*)	*A. T.*[2]= (*50*)	*No. C*=	(*a*	*d*)
R	9.1	10.4	43	18	25
Q	10.8	12.5	43	26	17
A	12.7	12.3	21	8	13
S	13.0	13.9	39	24	15
C	14.6	8.7	21	11	10
P	17.0	13.5	32	19	13
M	18.1	14.8	30	15	15
L	20.8	16.9	35	17	18
O	24.5	17.1	29	13	16
N	32.8	27.2	37	17	20
			Total.....	168	162

A. T.[1] (100) = Average time for the first Decision on 100 groups.
A. T.[2]= (50) = Average time for the second Decision on 50 "Non-suggestion groups."
No. C= = Number of Decision changes in Non-suggestion groups.
a and d = Number of changes in Decision for agreeable and disagreeable cards respectively.

The mean average time for all the subjects is less for these aesthetic decisions than for groups of five in the last investigation —17.34 and 19.30 respectively. It will be remembered that in the last experiment the five cards were arranged in order, while here only the best and worst were selected. One would suppose that this difference in requirement would have effected a saving of more than two seconds; but probably the selection of the first and the last is the most difficult part of the arrangement. The actual saving may be really larger than the figures show (i.e., 2″); because for the only three subjects that participated in both inves-

tigations it is 5.2″; and the figures of Table XIX seem to indicate that the effect of practice upon decision time is very small if not altogether absent. The saving for subjects A and C is much greater than for L, whose time is only slightly quicker in the aesthetic decisions. Of course, the difference in time may be due to difference in material, as well as to difference in the decisions required. The time for arranging a group of three in the last experiment was 8.5″. This, therefore, is about the difference we would expect between arranging a group of five in order, and selecting the best and worst from a group of five. The actual difference is about 3″ less than this. It is, therefore, probable that the aesthetic decisions on actual objects would, other things being equal, require more time than the previous more or less logical decisions.

As in the previous experiment, the decision time for the second presentation is usually less than for the first; but here again there are two exceptions, R and Q. Subjects C and L both decrease their time about as much relatively as before, showing that this is a constant tendency with them, as no doubt to increase, decrease, or remain the same is with every subject. These individual differences are very difficult to interpret; but see the discussion of this subject above (pp. 8-9).

The results for the second presentation of the fifty "suggestion groups" are given in Table XVII. The subjects are arranged roughly on the basis of suggestibility. The purely suggestible are placed first; then those that likewise give evidence of contra-suggestibility, and finally the non-suggestible. The average times for the "suggestion groups" are in column A. T.$^{2+}$. The 2 means second presentation, and the plus sign means "with suggestion." just as in Table XVI the "equals" sign means "without suggestion." In column C+ (a d), we have first the total number of changes in decision for the fifty groups, and then the number of changes in the decisions upon "agreeable" and "disagreeable" cards. Contrary to what we obtained in Table XVI, we see that the total number of changes is greater for the "d" column than for the "a" (220 and 203), which signifies that the *sugges-*

tion was accepted oftener in the case of the unpleasant than the pleasant choice; but here again there are some individual differences.

There is *less* variation in *time* and *more* in the number of changes here than in the "non-suggestion groups"; but we shall enter into a more detailed comparison of the two groups in the discussion of Table XVIII. Here we wish to bring out chiefly the method of determining the relative suggestibility of the subjects. The best way of doing this would seem at first glance to be to compare the results (especially the number of changes) for the suggestion groups with those for the non-suggestion groups. This procedure, however, presupposes that the number of changes would have been the same for each series, if there had been no suggestion; and we are not at all certain that with a limited number of cases this is true. A form of procedure somewhat less open to such a criticism is to consider the results of the suggestion groups by themselves. An illustration will best explain how suggestibility can be calculated in this way. Let us suppose that E, D, C, B, A, is a group, presented to the subject in this order from left to right; then E and A are the suggestion cards for best and worst respectively, B and D the subject's previous choices for best and worst respectively, and C the only neutral card. If B and D are selected as before, the subject is constant; but he produces a change by any of the following decisions or combinations thereof: (1) by accepting the suggestion; (2) by choosing C as either best or worst; (3) by reversing the suggestion.—that is, taking A as best and E as worst; and (4) by reversing his own previous decision,—that is, taking D as best and B as worst. The last possibility is practically negligible, as it occurred only once or twice in the whole investigation. No. 3 was taken as an evidence of contra-suggestibility; for the possibility of such a decision, if there were no suggestion, would be very low, since E and A were really chosen by at least three subjects, sometimes by many more, as best and worst respectively, and therefore most probably really differ in this way. This kind of decision is signified by the sign—; No. 2, showing non-suggestibility, by the sign =, and No. 1,

showing suggestibility, by the sign +. Changes in decisions for both best and worst are counted two; a change in either one of them, one. The results are summarized in column C+, Table XVII. Subject R, e.g., has a total of 51, changes, 38 due to acceptance of the suggestion, 9 to non-acceptance, and 4 to reversal. Since acceptance is due to the choice of either of two cards (E or A), and non-acceptance to the choice of only one (C), there would be, without any suggestion, twice as many acceptances as non-acceptances. Therefore, suggestibility is shown in proportion as the + number in column C+ is more than twice as great as the =. Subject R, e.g., shows considerable suggestibility, for his + number (38) is more than *four* times as large as his = (9).

TABLE XVII

Subject	*A. T.*²+ (50)	*C+*	(*a*	*d*)		*C+*		
R	10.0	51	27	24	38+	9=	4—	
Q	13.3	63	29	34	44+	15=	4—	Sug.
P	14.1	38	19	19	30+	7=	1—	
O	18.2	44	18	26	36+	4=	4—	
L	19.1	52	27	25	35+	8=	9—	Sug. and
C	10.0	39	19	20	19+	10=	10—	Contra-sug.
M	16.7	46	19	27	24+	15=	7—	
N	26.5	27	14	13	14+	8=	5—	Contra-sug.
A	12.9	30	12	18	17+	10=	3—	Non-sug.
S	14.1	33	19	14	22+	11=		
	Total.....	203		220				

A. T.²+ (50) = Average Decision time for "suggestion groups."
C+ (a d) = Total Decision changes, changes in choice of agreeable and of disagreeable cards.
C+ = For explanations of this column see pages 34, 35.
Sug. = Suggestible.

Contra-suggestibility is shown to some degree by all the subjects except S and P. The former is also not at all positively suggestible, while the latter is to a considerable degree. Subject L is both negatively and positively suggestible, while C, M, and N are only negatively suggestible. It would seem, then, that negative and positive suggestibility need not be inversely correlated in the individual but that any degree of one can coexist with any degree of the other. The fact that the same subject may be both

positively and negatively suggestible is not at variance with ordinary observation. We all know individuals who alternate between periods in which they are easily influenced and periods of inflexibility.

There are, as we have intimated, other ways of estimating the suggestibility of the subjects from the results of our experiment. These are perhaps, less reliable than the one explained above, but they afford us very important auxiliary evidence regarding the status of the individual subjects; and also, since they depend upon a comparison of the results of the "suggestion" and "non-suggestion" groups, lead to a consideration of the influences of suggestion upon decision. This comparison is facilitated by the use of Table XVIII. Here the subjects are arranged according to the average time for the first decisions upon the hundred groups. In columns two and three are presented the average times for decisions upon the "non-suggestion" and "suggestion" groups respectively. In only two cases (R and N) is the time for the suggestion groups the shorter, and then only very slightly so. The other subjects differ considerably; for some (such as L, M and C) the time is relatively much longer for the suggestion groups; for others (Q, P, S, A, and O) it is only slightly longer. The lengthening of this time shows a general disturbance due to the suggestion, and probably an attempt to overcome it. It may, therefore be taken as an evidence of some degree of suggestibility; and it is noteworthy that it is most pronounced in the case of the subjects that show the greatest contra-suggestibility. That is, the process of resisting increases the decision time. A shortening of the time cannot, however, be taken as an evidence of the absence of suggestibility. It may, on the contrary, be explained as the result of an immediate yielding to the suggestion, as it seems to be, e.g., in the case of subject R. The subject who shows the least effect of the suggestion, viz., S, shows also the least difference in time.

The variation from the central tendency in decision time is greatest for the first presentation of the hundred groups, the limits being 9.1″ and 32.8″. It is less for the second presentation

of the "non-suggestion groups," where the limits are 8.7″ and 27.2″; and it is least of all for the second presentation of the "suggestion groups," where the limits are 10″ and 26.5″. Hence the general effect of suggestion upon time in decision is to lengthen it, and reduce the variability of one subject from another.

Another method of calculating the relative suggestibility of the subjects is to compare the number of changes in non-suggestion and suggestion groups, as mentioned above (p. 34). These are given in Table XVIII, columns C= and C+ respectively. In only two cases (N and S) is the number of changes less in the C+ than in the C= column. The other subjects vary greatly, showing increases that range from 6 for M and P to 20 for Q. If we estimate the relative suggestibility of the subjects from the amount of the increase in the number of changes, the classification will be about like that of Table XVII, except that subject C will be more and P less suggestible.

As might be expected, the suggestions on the whole increased the inconstancy. It increased it, however, much more for some subjects than for others. The limits in the C= column are 21 and 43, while in the C+ column they are 27 and 63. This increase of inconstancy bears no marked relation to the inconstancy as determined by the fifty non-suggestion groups. Subject C, e.g., who was constant in the latter, has a relatively larger increase than subject R, who was inconstant; and the two subjects who actually decreased the number of changes were relatively inconstant. On the other hand, large *increases* were made by the relatively inconstant subjects Q and L.

In the second C+ column, we have presented the number of +, = and — changes as in Table XVII; and in column C=(+)C+, the total number of changes (+, = and —) for the suggestion and non-suggestion groups combined. A change in any of the latter groups is produced by the selection of any one of *three* possible cards (excluding the possibility of the subject reversing his own previous decision). All changes in non-suggestion groups are, of course, = changes. Taking then any

two decisions, one without and one with suggestion, we have four possibilities of = changes, three in the former, one in the latter; and two of + changes, both in the latter. That is to say, in the whole hundred decisions we should have, barring the influence of suggestion, twice as many = as + changes; and the degree of suggestibility will be proportioned to the amount that the + changes exceed half the = changes. If we arrange the subjects on the basis of this calculation, we shall, on the whole, maintain the classification of Table XVII; but the positive suggestibility of subjects C and M and the negative suggestibility of subject N are thus better brought to light.

TABLE XVIII

Subject	(100) A.T.¹	(50) A.T.²=	(50) A.T.²+	C=	C+		C+		C=(+)C+			Sug.
R	9.1	10.4	10.0	43	51	38+	9=	4—	52=	38+	4—	3+
Q	10.8	12.5	13.3	43	63	44+	15=	4—	58=	44+	4—	3+
A	12.7	12.3	12.9	21	30	17+	10=	3—	31=	17+	3—	2+
S	13.0	13.9	14.1	39	33	22+	11=		50=	22+		=
C	14.6	8.7	10.0	21	39	19+	10=	10—	31=	19+	10—	2+—
P	17.0	13.5	14.1	32	38	30+	7=	1—	39=	30+	1—	3+
M	18.1	14.8	16.7	30	46	24+	15=	7—	45=	24+	7—	2+—
L	20.8	16.9	19.1	35	52	35+	8=	9—	43=	35+	9—	3+—
O	24.5	17.1	18.2	29	44	36+	4=	4—	33=	36+	4—	3+
N	32.8	27.2	26.5	37	27	14+	8=	5—	45=	14+	5—	—
	17.3	14.7	15.5	330	423	..... Total						
	Mean of Averages											

A. T.¹ = Average time for first 100 Decisions.
A. T.²= = Average time for second Decisions on 50 "non-suggestion groups."
A. T.²+ = Average time for second Decisions on 50 "suggestion groups."
C= = Decision changes in non-suggestion groups.
C+ = Decision changes in suggestion groups.
For second C+ column and C=(+)C+, see pp. 37-38.
Sug. = Index of suggestibility.

There are thus three ways of calculating suggestibility if we omit the comparison of time, which has a rather ambiguous significance. If the suggestibility shown in any one of these ways is called 1+, an arbitrary index of suggestibility for each subject is obtained. This is given in column "Sug.", Table XVIII. 3+ means that suggestibility is shown by all three methods; 2+, by two; =, by none; 2+— means suggestibility by two methods coupled with contra-suggestibility; —, contra-suggesti-

bility only, etc. The subjects seem to fall into four groups or types on the basis of suggestibility: (1) the positively suggestible; (2) the positively and negatively suggestible; (3) the non-suggestible; (4) the negatively suggestible. The last has only one representative (N) in this group of subjects. No. 3 seems to have only one also (S); but since for A the margin for suggestibility is very low in both methods in which it occurs, he should probably be placed in this type instead of No. 1. It is, of course, understood that these types are not distinct, but grade into each other as the "decision types" considered above.

There appears to be no correlation between suggestibility and decision time or constancy. There are quick and slow, constant and inconstant in the two types of suggestibility that are fairly represented; and this would probably also be the case with the other two, if there were more subjects. There may, however, be some significance in the fact that the contra-suggestible appear, on the whole, in the lower half of the column, and two of the most suggestible at the top. If so, it would mean that extreme quickness in decision time usually goes with suggestibility, and extreme slowness with contra-suggestibility, while the non-suggestible would be medium or fair in decision time. We have not, however, sufficient data in support of this view.

So far we have been considering the results of all the decisions combined. Let us now turn to a comparison of the results for the different kinds of objects decided upon, viz., colors, geometrical figures, pictures, post cards, and words. There were thirty groups of colors, ten of words, and twenty each of the others. Each subject's average decision time for each kind of material decided upon and also his average for the whole hundred are given in Table XIX. The central tendency of all the subjects for each series is also given at the foot of the table. On the whole, the subjects show a decrease of time from colors to geometrical figures, an increase from these to pictures, a still further increase to post cards, and a final decrease to words. The groups were presented to the subjects in this order; and if they were all of approximately equal difficulty, one would expect a decrease of

time from one series to the next due to practice. The increase can, therefore, be accounted for only by the greater difficulty of the decisions upon pictures and especially post cards. It is most probable also that practice would have very little effect upon decision times.

The above states the general tendency; but there are very marked individual differences in the way the subjects vary in time from one series to another. Subjects R, Q, and A vary from the central tendency in showing an increase of time from colors to geometrical figures; C and M, in showing a decrease from geometrical figures to pictures; S, in showing a decrease from pictures to post cards; and R and L, in showing an increase from post cards to words. That is to say, although on the whole geometrical figures are the easiest to decide upon, yet subjects R, Q, and A find colors, and M, words, slightly the easiest, and C, the pictures much the easiest. These variations are significant, for they seem to show that decision times vary relatively with the kind of material,—and this means that a person may be relatively quick in one kind of decision and relatively slow in another. Such variations are, however, the exception. One subject, R, shows increase for every series, and Q and A, for all except the last, while C and M show decreases for every series except the post cards. It is interesting to note that the former are also the subjects that show the *increase* in decision time for the second presentation, as are the latter those that show the greatest decrease. This correlation is no doubt due to the greater adaptability of the latter.

The coefficient of variability (column C. V.) is obtained for each subject by dividing the mean variation of his times for the five series by his average time for the whole hundred decisions. While this coefficient is probably not so accurate as that which could be obtained by finding the mean variation for each subject's times for the *hundred* decisions, yet it is sufficient for our purposes. The most "uniform" subjects are M and A, who have C. V.'s of .12 and .13 respectively; and the most variable are N and C, with C. V.'s of .36 and .31. Subjects A and C were also

"uniform" and "variable" subjects respectively in our first investigation; and we also note here, as we did then, that there is no correlation between a subject's variability in his own decision time and his variability from the average for all the subjects. This result is significant; for it is thus possible to obtain subjects who are not only quicker than the average but also more uniform in time. Variability in time is not correlated with decision time, constancy, nor suggestibility; but if we refer to Table XIV, we shall see that the subjects who have the greatest C. V., show as a whole the greatest influence of what we have there termed "Inertia." This is not surprising, for the "uniform" subjects are those that standardize their time by *easily* bringing into play in difficult situations large amounts of reserve energy; while the variable subjects either have not the extra energy to expend or find it difficult to force into activity; that is, their inertia is great.

TABLE XIX.

Subject	*A.T.*[1] (*100*)	*C.* (*30*)	*G.* (*20*)	*Pict.* (*20*)	*P.C.* (*20*)	*W.* (*10*)	*C.V.*
R	9.1	6.9	8.1	8.8	10.5	15.7	.25
Q	10.8	8.1	9.2	12.1	12.6	12.3	.17
A	12.7	10.7	11.5	11.9	15.5	14.1	.13
S	13.0	11.6	11.4	17.8	16.0	11.4	.19+
C	14.6	18.6	11.3	8.3	20.2	10.7	.31
P	17.0	14.1	12.5	16.7	25.2	19.1	.21
M	18.1	21.8	17.5	16.0	18.2	13.7	.12
L	20.8	18.9	14.3	21.1	26.1	28.4	.20
O	24.5	29.4	18.5	21.9	28.5	19.0	.19—
N	32.8	26.6	20.1	36.2	57.9	20.5	.36
Mean Averages	17.3	16.7	13.4	17.1	23.1	16.5	

A.T.[1] (100) = Average time for the first decision on 100 groups.
C. (30) = Time for thirty decisions on colors.
G. (20) = " " twenty " " geometrical figures.
Pict. (20) = " " " " " pictures.
P. C. (20) = " " " " " post cards.
W. (10) = " " ten " " words.
C. V. = Coefficient of variability.

We pass now to a comparison of the results of the different series in constancy and suggestibility. In Table XX, we have summarized these results, combining the "suggestion" and the "non-suggestion" groups. Column 1 contains the changes of each subject for the whole hundred decisions: those in which the

suggestion was not accepted (or not given), those in which it was accepted, and those in which it was reversed. In the other columns are similar results for the colors, geometrical figures, pictures, post cards, and words. The constancy of the subjects is shown by the = numbers, and the influence of the suggestion by the + and — numbers. The subjects are arranged in the order of their constancy which is indicated by the = numbers for the total in column 1,

The totals for all the subjects at the foot of the table show that on the whole the constancy (as shown by the = numbers alone) is relatively about the same for each series. For the whole hundred decisions the number of = changes is 427; that is, about 43 for each ten. At this rate we would get 129 for the thirty colors, 86 each for the geometrical figures, pictures and post cards, and 43 for the words. *Omitting the last,* the pictures show the least number of changes and the post cards the most; but the differences are much less than we would expect. The individual subjects, however, show greater variations, and show them in different ways. These variations are brought out in Table XXI, where, omitting the words, the series in which each subject is most constant and that in which he is least constant are given. Subject A is about the same in each series.

TABLE XX

Subject	(100) C=(+)C+	*30 C.*	*20 G.*	*20 Pict.*	*20 P. C.*	*10 W.*
A	31= 17+ 3—	8= 4+ 1—	6= 7+ 1—	7= 3+	7= 3+ 1—	3=
C	31= 19+ 10—	9= 6+ 1—	2= 7+ 1—	3= 2+ 2—	13= 1+ 4—	4= 3+ 2—
O	33= 36+ 4—	11= 15+ 1—	11= 7+	4= 8+	6= 5+ 2—	1= 1+ 1—
P	39= 30+ 1—	9= 9+	10= 6+	9= 3+	8= 8+ 1—	3= 4+
L	43= 35+ 9—	9= 11+ 3—	15= 9+ 3—	5= 5+ 3—	11= 6+	3= 4+
M	45= 24+ 7—	19= 10+ 1—	8= 3+ 3—	9= 4+	7= 4+ 3—	2= 3+
N	45= 14+ 5—	17= 7+ 1—	6= 3+ 3—	7= 1+	10= 3+ 1—	5=
S	50= 22+	15= 5+	8= 8+	10= 4+	14= 3+	3= 2+
R	52= 38+ 4—	19= 9+ 1—	12= 12+ 1—	9= 8+	9= 7+ 1—	3= 2+ 1—
Q	58= 44+ 4—	19= 10+ 2—	10= 11+ 1—	16= 10+	9= 11+	4= 2+ 1—
Totals	427=279+ 47—	135= 86+ 11—	88= 73+ 13—	79= 48+ 5—	94=51+13—	31=21+ 5—

(100) C=(+)C+ = The number of changes for the one hundred decisions,—non-suggestion and suggestion groups combined.
30 C. = As above for thirty decisions on colors.
20 G. = " " " twenty " " geometrical figures.
20 Pict. = " " " " " " pictures.
20 P. C. = " " " " " " post cards.
10 W. = " " " ten " " words.

TABLE XXI

Subject	*Constant*	*Inconstant*
A		
C	Pict. & Geom. Fig.	Post Cards
O	Pictures	Geometrical Figures
P	Colors	Geometrical Figures
L	Pictures	Geometrical Figures
M	Post Cards	Colors
N	Geometrical Figures	Colors
S	Geometrical Figures	Post Cards
R	Pict. & Post Cards	Colors
Q	Post Cards	Pictures

The influence of the suggestion is shown by the + numbers in Table XX; and, as explained above, the degree of suggestibility by the amount which the + numbers exceed half the = numbers. If we wish to compare the influence of suggestion in the various series, we must compare not the total numbers but their relation to the = numbers. Thus, for a total of 427 = numbers. there are 279 + numbers; that is, an excess of 66 over half the = numbers. The following are the estimated excesses at the same ratio and the actual ones:

	C.	*G. F.*	*Pic.*	*P. C.*	*W.*
Estimated	20.8	13.5	12.2	14.5	4.8
Actual	18.5	29.0	8.5	4.0	5.5

If the force of the suggestion were wearing off, we would expect a gradual decrease from colors to words; but the rate is really slightly greater for words than for colors; and we are. therefore, justified in saying that the very low figures for post cards and for pictures cannot be due to a diminution of the force of the suggestion. On the other hand by far the greatest suggestibility is shown in the case of geometrical figures. An explanation that suggests itself is that the decisions were on the whole more indifferent here; but, if inconstancy means indifference, then the post cards in that they show the most inconstancy are the most indifferent. Yet they show the least influence of suggestion. The greater influence of suggestion in the case of the geometrical figures must, therefore, remain unexplained.

Contra-suggestibility is shown by the — numbers, and here also their relation to the = changes must be considered for com-

parison. The following are the figures estimated from the ratio of 427= to 47—; and also the actual figures:

	C.	*G.F.*	*Pic.*	*P.C.*	*W.*
Estimated	15.0	9.7	8.7	10.4	3.4
Actual	11.0	13.0	5.0	13.0	5.0

The contra-suggestibility is large not only for the geometrical figures, which showed also the greatest effect of suggestibility, but also for the post card series, in which direct suggestibility was least. Contra-suggestibility is small for colors and pictures.

Many of the subjects show marked deviations from the general tendencies, so far considered. These variations are brought out better in Table XXII, where the series in which each subject shows the most suggestibility, the least suggestibility, and the greatest contra-suggestibility are given. The words are omitted. The individual differences here shown need not be further commented upon. An enumeration of the various series mentioned shows that there is most suggestibility for geometrical figures; and both least suggestibility and most contra-suggestibility for post cards. These results are in accord with those of W. D. Scott[1] and add weight to his view that suggestibility is not a general trait; but that there exist only varying degrees of specific *suggestibilities.*

TABLE XXII

Subject	*Most Sug.*	*Least Sug.*	*Contra-Sug.*
A	Geometrical Fig.	.....	.....
C	Geometrical Fig.	Post Cards	Post Cards & Pict.
O	Pictures	Geometrical Fig.	Post Cards
P	Colors & Post C.	Pictures	.....
L	Colors	Post Cards	Pictures
M	Post Cards	Geometrical Fig.	Post Cards
N	Geometrical Fig.	Pictures	Geometrical Fig.
S	Geometrical Fig.	Post Cards	.....
R	Geometrical Fig.	Colors	.....
Q	Post Cards	Colors	.....

The subjects were not asked for introspection upon the influence of the suggestion during the experiment; but very often it was given gratuitously. Of the suggestible subjects, R denies

[1] W. D. Scott, Personal Differences in Suggestibility, Psych. Rev. 17, 1910, pp. 147-156.

any influence, but Q, O, and P acknowledge it. Subject L, who is both positively and negatively suggestible acknowledges both tendencies in his introspection; S and A deny any effect of the suggestion; and the other subjects do not mention the fact at all. On the whole the introspection points to the correctness of our classification. At the end of the investigation the subjects were questioned regarding the influence of the "special arrangements," and whether they guessed the purpose of the experiment. Most of them said they did not think of the latter at all; and none of them ever thought they were being deceived regarding the card the majority had chosen as best and worst. All of them felt surprised that they should differ from the majority so often; but the introspection on the influence of the "special arrangement" differs from subject to subject,—in general, verifying our classification as to suggestibility. Some of the more suggestible subjects (e.g., O and P) said they often took the cards suggested because it was the easiest thing to do when a decision would be difficult. Subject M said he felt influenced against the suggested cards; and both C and N acknowledge considerable pride in differing from the majority; these three were classified as contra-suggestible. Subject S (non-suggestible) said he felt sometimes like defending the card the majority thought was *worst*. *A* knew more of the purpose of the experiment than the others; and his suggestibility is probably greater than calculated here. It is interesting to note that very often when a subject accepted the suggestions, he remarked that he remembered choosing the same card before, when of course he was really making a different choice.

The subjects were asked, especially in the first presentation, for introspection upon the decision itself; but this was not emphasized as the investigation has no direct bearing upon the introspective analysis of the "Act of Decision" itself. The material obtained, nevertheless, shows that the decisions were always brought about in one of the following ways: (1) it succeeds an immediate feeling attitude, which may be of various kinds but not further explicable; (2) the feeling is explicable,—

that is, the subject can tell *why* the object is pleasant or unpleasant, what factors in the situation produce it, etc.; (3) the feeling is aroused not by the object itself, but by something, more or less closely associated with it. The one invariable factor in these aesthetic decisions is the feeling. The nature of the feeling itself, the *kind of object* which produces it, and the kind of association which arouses it, all differ greatly from subject to subject. Many individual differences in this respect might be obtained by a careful study of the introspection and the nature of the objects chosen by each subject; but the results would scarcely repay the immense amount of work necessary to obtain them, especially as this is not an investigation in the psychology of aesthetics.

ACCURACY OF DECISION

The subjects were tested for accuracy of decision by the same method used in the last investigation. This time only cards containing from 44 to 55 holes were used for the comparisons; and the group areas were always the same, but the subjects were not informed of the latter fact. In the previous experiment we noted that certain illusions produced constant errors. In order to overcome this factor as far as possible, the subjects were always told whether their decisions were right or wrong, and were thus enabled to correct their judgments by experience. Two series of fifty decisions each were obtained. In one the time for each decision was taken with a stop watch; in the other a constant time of 5″ was given for each.

The results for both series are given in Table XXIII. There is a very great variation in time: from 2.6″ to 12.8″; and, contrary to our last investigation, there seems to be a pretty close correspondence between the times in the constancy of decision test, and those in the accuracy of decision test. In the Table the subjects are arranged according to time; and the first five here are, with one exception, the same as the first five in Table XVI, where they are arranged according to time in the constancy of decision test. This correlation may be due to the fact that the two kinds of

decision are more alike in this investigation. Aesthetic decisions in which the *actual objects* are compared are probably more like the decisions we have required for accuracy than are the more logical decisions of the first investigation.

TABLE XXIII

Subject	*A.T.(50)*	*E.¹(50)*	*E.²(50)*	*T.E.*	*C.V.*
A	2.6	18	19	37	.23
Q	4.0	23	19	42	.32
R	5.1	17	18	35	.31
M	5.2	18	18	36	.33
C	5.5	18	17	35	.27
O	6.3	22	15	37	.26
P	7.3	24	19	43	.44
L	7.9	17	18	35	.38
N	9.0	24	28	52	.56
S	12.8	18	12	30	.47
		199	183	382	

A.T. = Average time for fifty decisions.
E.¹ = Errors for the fifty in which time was taken.
E.₂ = Errors for the fifty in which the time was constant (5″).
T.E. = Total errors.
C.V. = Coefficient of variability.

In column E.¹ are the number of errors for each subject in the fifty decisions in which the time was taken; and in E.² the number for those in which the time was a constant quantity (5″). The number of errors is on the whole less for the latter. This is probably not because the time was allotted, but because some of these decisions were really easier than in the other series. The difference between the number of holes in the two cards presented was usually from five to 0; but in twenty-five pairs of this series, it was from 10 to 0. Corresponding to this *objective* difference, there was a greater *subjective* ease in the decisions; for in these twenty-five decisions there were a total of 76 errors, while in the other twenty-five of the series there were 107. In the series in which the subjects were told to decide as quickly as possible and the time measured, the errors for the second twenty-five numbered 103. This series was the first given, and we should have expected a decrease in the number of errors through practice. Hence, the increase from 103 to 107 errors for the same twenty-five decisions shows that the allotment of a constant time (5″) on the whole *decreased* the accuracy. Of course the time given

(5″) hastened only the relatively slow subjects, while some of the quick ones were given extra time. The noticeable thing is that the *lengthening of the time for the quick subjects did not on the whole effect their accuracy, while the shortening of the time for the slow subjects seems to have, in some cases, actually increased their accuracy;* e.g., subjects O, P, and S, whose times are much over 5″, make fewer errors when compelled to decide in a hurry; N and L, however, make more. These statements are verified by the results for the twenty-five decisions that were the same in each series, as well as by Table XXIII. A possible explanation is that the most reliable judgments are based upon the immediate *feeling of difference,* that the time required for the development of this feeling is different with different subjects; and that, if left to themselves, some subjects tend to go by this feeling, while others over-rationalize and by trying to consider all the pros and cons in the situation greatly lengthen their time and on the whole decrease their accuracy. Such subjects do better if hurried; but of course there is also danger of over-hurrying; for if the time is so short that the feeling of difference has not completely developed, the errors may be again increased. All this is merely hypothetical, but the actual increase of accuracy with decrease of time observed in some cases adds weight to the view that there may be an *optimal judgment time.* V. A. C. Henmon says: "There may be an optimal time for judgment, varying with individuals and with varying stimuli and conditions, and judgments made too soon or too late are apt to be wrong."[2] This view could be experimentally tested by getting decisions on the same material with times longer and shorter than the time taken by each subject when left to himself.

The total number of errors in comparison vary from 30 for S to 52 for N. As before, we find no correlation between accuracy and time; and the four types,—quick accurate, quick inaccurate, slow accurate, and slow inaccurate, are, therefore, represented but not clearly demarcated.

As in the last investigation, we find some evidence of a correla-

[2] The relation of the time of a judgment to its accuracy, Psych. Rev. 18, 1911, pp. 186-201.

tion between quickness in subjective decisions (here aesthetic) and accuracy in objective; but this correlation is not as marked as before. It is shown by the most accurate and the most inaccurate subjects, but not by the intermediate. The most accurate subject in the list (S) is quick in subjective decisions and slow in objective; but capable of doing just as well if compelled to make the latter decisions more quickly. This subject is also the least suggestible. There is no perfect correlation brought out between suggestibility and accuracy; but three of the most suggestible subjects (Q, P, and O) are also inaccurate.

A coefficient of variability is obtained for each subject in the following day: The probable error is first found by arranging the decision times in order of magnitude, counting off one-fourth of the cases from each end of the series and halving the difference between the two values thus obtained.[3] This probable error for each subject is then divided by his average decision time. The slowest subjects here have the largest coefficients. This was not the case in aesthetic decisions. Moreover, there is no complete correlation between the coefficient of variability here and that for aesthetic decisions. Subjects S and M, who have very low coefficients in the latter, have large ones here; and R and C are just the reverse. The other six subjects are about the same *relatively;* but the C.V. is, on the whole, larger in this experiment. There is some appearance of a correlation between variability in decision time and inaccuracy. There are three very variable subjects; two of these are the most inaccurate in the list; while, curiously enough, the other (S) is the most accurate. On the whole, therefore, we may say that variability is here, as in the previous experiment, an independent factor, not *definitely* correlated with either time, accuracy, or suggestibility.

As in the previous similar experiment, each subject was asked to state his confidence as A, B, or C, in each decision; the meaning of these symbols and the method of evaluating them has been described above. In Table XXIV are given in numerical values, the total confidence of each subject for the hundred

[3] See Whipple's "Manual of physical and mental tests." page 18.

decisions, and his average confidence for correct decisions and for errors. The subjects are arranged in the order of their total confidence, with the most confident first. If this total confidence for each subject is compared with his number of errors in column T. E., the previous observation that "the *confident* subject is no more liable to be correct than the *inconfident*" is amply verified. In fact, two of the most confident subjects (P and N) are the two most inaccurate. The least confident subjects come next; and the subjects with *medium confidence* have the highest accuracy.

If now the average confidence for correct decisions be compared with that for errors, the former conclusion that a *confident judgment of any given subject is more liable to be correct than a less confident one by the same subject,* is also verified. The difference between the mean average confidence for correct (1.1) and for incorrect (.8) decisions is, in general, less than might be expected; but this difference is much greater for some subjects than for others. The most confident subjects show the least differences; and the greatest differences are shown by A, O, and L,—relatively inconfident subjects. In other words, a subject who is by nature very confident is just about as confident when he is wrong as when he is right; while one who by nature is of medium or little confidence varies greatly from his correct to his incorrect decisions. In the latter case the probability of being correct increases with the confidence; in the former it does not.

Henmon in his work on judgment studied the relation of confidence to accuracy, and concludes that "There is a positive correlation on the whole between degree of confidence and accuracy; but the degree of confidence is not a reliable index of accuracy."[4] This is in perfect accord with our finding that the confident judgment of a given subject is more liable to be correct than an inconfident one by the same subject. Henmon, however, did not distinguish between confident and inconfident subjects; but only between confident and inconfident judgments; and, therefore, his conclusion is quite compatible with the statement made above that the confident subject is not more apt to be correct than the inconfident.

[4] Ibid. Page 200.

TABLE XXIV

Subject	*T.C.*	*A.C.C.*	*A.C.E.*	*T.E.*
C	146	1.5	1.3	35
P	139	1.5	1.3	43
N	125	1.4	1.1	52
R	93	1.0	.8	35
S	92	1.0	.7	30
L	86	1.0	.5	35
Q	86	1.0	.6	42
A	77	1.0	.3	37
M	76	.8	.7	36
O	72	.9	.4	37
Average Con. for each Dec.	99	1.1	.8	

T.C. = Total confidence.
A.C.C. = Average confidence for correct decisions.
A.C.E. = Average confidence for errors.
T.E. = Total errors in accuracy of decision test.

SITUATION TEST

In connection with the experiment on accuracy of decision, it will be well to state the results for the "Situation Test" (or A, E, O, U Test). This test was originated by Professor Münsterberg in the interest of the ship service; and is described in his "Psychology and Industrial Efficiency."[5] It aims to determine reliability of judgment in an emergency; and, therefore, like the experiment just reported tests degree of accuracy and rapidity in decisions. The comparison of the number of holes in two cards is, however, a relatively simple decision, while the A, E, O, U Test introduces a much more complex situation. There are more factors to be eliminated and the experience is more *baffling* than in the comparison test. The latter may probably be considered as a test for accuracy and rapidity of decision in ordinary, every-day life, while the former tests the same factors in an emergency. Of course, these two traits may or may not be correlated. It would not be unreasonable to suppose that many people who are accurate and quick in ordinary life affairs would lose their heads completely in an emergency. We shall, therefore, not be surprised if the results of these two tests are not identical.

The results are given in Table XXV. The product of the time multiplied by the number of errors in our experiment on

[5] Pp. 83-96.

accuracy of decision is also given for comparison. As expected, there is not a close correspondence; but the largest products in both experiments are in the lower half of the columns and the smallest in the upper. There are four exceptions to this: L, O, A and R. None of the ten subjects have products less than 1661 in the situation test, while according to the author of the test, the perfectly reliable should make a product of 400 or less. The importance of considering not only the product but also the time and the number of mistakes in estimating any individual is well illustrated by this table. Subject O, e.g., who has the fewest mistakes, is disqualified by the great length of time; and Q, who has the shortest time, is disqualified by the number of errors. On the whole, neither the products just considered, nor the number of errors, nor the time in this test corresponds completely to the same factors in the comparison test.

TABLE XXV

	Situation Test II				
Subject	*Product*	*Time*	*Mistakes*	*Test I*	*T x E in C*
L	1661	151″	11	18.2″	276.5
Q	1890	105	18	21.2	168.0
M*	2040	120	17	20.0	187.2
O	2130	355	6	23.0	233.1
C	2190	146	15	15.4	192.5
A*	2300	230	10	16.4	96.2
S	2440	244	10	16.4	384.0
P*	2646	126	21	18.2	333.9
R	2814	134	21	24.0	178.5
N	3300	150	22	41.6	468.0

Product = Time x number of mistakes.
Test I = Time for sorting the cards into four groups,—A, E, O, U.
T x E in C = Time x errors in experiment on comparison of number of holes.
* = Subjects who had taken the test before.

If the number of errors alone be considered, an interesting correlation between them and suggestibility is revealed. This is shown in Table XXVI. It will be seen that with one exception the non-suggestible make the fewest errors; those who are both positively and negatively suggestible come next; and the most mistakes are made by those who are positively suggestible alone or negatively suggestible alone (N). This correlation is not unexpected, when the actual experience in performing the test is

considered. This shows that when a card is selected as having more of any given letter, there is a tendency to look for and hence find the same letter predominating in the next card. This tendency is greater for and not so easily overcome by the suggestible subjects. Subject O's exceptional position can be explained by supposing that she was able to overcome the force of this suggestion by greatly prolonging the time. The situation test thus becomes a good test for a certain kind of suggestibility; but this may be no objection to it as a test for reliability in emergency; for those who lose their heads in an emergency may always be suggestible people.

This correlation with suggestibility is shown but not so well by the errors in the comparison test (Table XXVI). We have remarked in Chapter I that this test brings out a liability to illusions, which is probably similar to the kind of suggestibility brought out by the "Situation Test." This liability to illusions tended to produce constant errors there; but in the later similar experiment this tendency was partly overcome by informing the subject of the correctness or incorrectness of each decision. Thus another factor was introduced which no doubt affected the results considerably.

TABLE XXVI

Subject	*E.S.*	*E.C.*	
O	6	37	Suggestible
S	10	30	Non-suggestible
A	10	37	
L	11	35	Suggestible and Contra-Sug.
C	15	35	
M	17	36	
Q	18	42	Suggestible
P	21	43	
R	21	35	
N	22	52	Contra-Suggestible

E.S. = Errors in "Situation Test."
E.C. = Errors in Comparison Test.

The method of evaluating the mistakes in the situation test deserves some consideration. In some cards the predominating letter occurs twenty-one times, in others eighteen times, in others

sixteen times and in still others fifteen times, out of a total of forty-eight. Hence, a mistake in the first card is much more serious than in the last, and this must be taken account of in evaluating the results. The method adopted was to count the mistakes in these cards as 4, 3, 2 and 1 respectively, on the assumption that their difficulty varied inversely as these numbers. Now this is the assumption that should be further investigated. It might be done by giving the test to a large number of people, and then estimating the difficulty of the respective cards by the total number of mistakes made in each. Such a record was kept of the ten subjects and the results are shown in Table XXVII. On the whole, the number of mistakes made in the 21, 18, 16, and 15 cards were 3, 30, 17, and 28 respectively; but since there are twice as many 18 and 16 cards as 21 and 15, the figures for equal numbers of cards would be 3, 15, 8½ and 28. Thus the 18 cards are really more difficult than the 16, since there were more mistakes made in them. This seeming paradox is explained by the fact that in the 16 cards a number of consonants are intermixed with the vowels; and, since the total number of letters is the same, the number of vowels from which the predominating one is to be selected is less, and thus the selection easier. Therefore, in making the calculations for Tables XXV and XXVI, mistakes in 16 cards have been valued at 3, those in 18 at 2, instead of the opposite. This, however, is only a provisional correction, and the results for many more subjects should be considered to obtain an accurate value for each card.

Supposing such a value were obtained, it might still be rendered invalid for some cases by another circumstance: viz., individual differences as to what card is found most difficult. The presence of consonants in the 16 cards may, in some cases, have the effect of increasing instead of decreasing the difficulty. This seems to have been actually the result in the case of subject P, who made 4 mistakes in 16 cards, to 1 in 18. For some subjects again, the subjective difficulty may not increase in proportion to the objective differences; for others it may. If on further investigation such individual differences turn out to be very great, the only way of evaluating the mistakes would be for each subject on the basis

of his own errors; and then comparison of one subject with another would be difficult or impossible. Other individual differences occur in the letters which are found most difficult. Cards in which the O or U predominated were usually found easier than those in which A or E predominated; but for some subjects the opposite might be true. Such differences, however, would not make any difference in the method of evaluating the mistakes; for the numbers are equally distributed among all the letters.

TABLE XXVII

Subject	*21*	*18*	*16*	*15*	*Total*
O	0	1	0	4	5
L	0	3	1	2	6
A	0	4	0	2	6
S	0	2	1	3	6
M	1	3	2	1	7
C	0	3	2	3	8
P	1	1	4	3	9
Q	0	3	3	3	9
R	0	4	3	4	11
N	1	6	1	3	11
	3	30	17	28	
	3	15	8½	28	

ASSOCIATION TEST

The subjects were tested for association time as in the first investigation. In all, forty reactions were obtained for each subject, and the time taken with a stop watch as before. The results are given in Table XXVIII. The times for the aesthetic decisions, and for the accuracy of decision test are also given for comparison. The correlation between aesthetic decision time and association time is more marked than that shown between "logical" decision time and association time in the last investigation. If the method of unlike signs, which considers only the nature (+ or —) of the deviation of the individual subjects from the central tendency and not its amount, be again applied here, it will be found that there are only two cases (L and Q) of unlike deviation,—that is, 20% cases of unlike signs; and this signifies, according to Whipple,[6] a correlation of about .8 between association time and aesthetic decision time. The correlation between

[6] "Manual of physical and mental tests," page 40.

time for comparison of the number of holes in two cards and association time is, however, less marked,—there being four cases of unlike signs. The time for sorting cards, as obtained in Situation Test I, follows the association time pretty well. The only marked exception is subject R, who was not used to handling cards and felt awkward about it. Subject N's time was greatly lengthened for the same reason. This is the nearest approach we have to a reaction time test; and the indications from it are that reaction time would be directly correlated with decision time.

TABLE XXVIII

Subject	*A.*	*M.*	*A.D.T.*	*C.T.*	*T.S.C.*
C	.94	1.0	14.6	5.5	15.4
S	.96	1.0	13.0	12.8	16.4
R	1.04	1.0	9.1	5.1	*24.0
A	1.06	1.0	12.7	2.6	16.4
L	1.09	1.0	20.8	7.9	18.2
P	1.24	1.2	17.0	7.3	18.2
N	1.29	1.3	32.8	9.0	*41.6
Q	1.32	1.2	10.8	4.0	21.2
O	1.35	1.2	24.5	6.3	23.0
M	1.61	1.5	18.1	5.2	20.0

A. = Average association time.
M. = Median association time.
A.D.T. = Time for aesthetic decisions.
C.T. = Time for comparison of the number of holes.
T.S.C. = Time for sorting cards, as shown in Situation Test I.
*. = Not used to handling cards—felt awkward about it.

In the last investigation, a correlation between quickness of association time and constancy in decision was brought out (see page 15). This provisional conclusion is not verified by the results of this experiment; but it must be remembered that the decisions were upon different material, and the results for constancy not so satisfactory and definite as in the previous case. Then there were many more experiments to obtain a constancy index and the method employed—arranging the whole five cards in order of preferment—is a much subtler means of bringing out the relative constancy of the subjects; but, of course, not so well adapted to the work on suggestibility as the one used in the second instance. The result here cannot, therefore, be considered as a refutation of the previous.

If now we compare the association times with the errors in the

accuracy of decision test (Table XXIII), we shall find that the quick subjects are, on the whole, the most accurate. There are only two cases of unlike deviation. It would seem then that, though quickness of association time does not surely guarantee quickness in the comparison of the number of holes in the cards, it does point more certainly to accuracy in this test. It may very well be that inaccuracy in the comparison test and slow association time depend upon a common factor; and this factor may be inhibition, delayed or erroneous apperception, or some other of the many factors that lengthen association time. We know from our association experiment that the slow subjects had many associations as quick as those of the quickest subjects, but reported many more obstructions, inhibitions, etc., so that these account, in part, at any rate, for the longer times. Such inhibitions and other irregularities occurred most frequently with subjects O and Q; to a considerable extent with M, N, P, and L; and almost not at all with the other subjects.

MEMORY TESTS

The method of testing the memory of the subjects was slightly different from that used in the previous investigation. The material was again figures, nonsense syllables, and words. Memory for figures was tested as before, except that the subject repeated each number from memory immediately instead of after a five-second interval. In testing memory for nonsense syllables and words, the Lipmann-Marx memory apparatus, which exposes the words successively at a very regular rate, was made use of. Lists of twelve nonsense syllables, and of eighteen unassociated words were constructed; and immediate memory efficiency or learning ability was measured by the number of repetitions required to memorize these lists. The memory was taken as complete when the subject could anticipate one word or syllable ahead throughout the list. In the case of the words the subjects were told to use artificial associations to help them in memorizing; but to prevent these as far as possible with the nonsense syllables. The object of this was to obtain a measure of association strength in the former case, as well as receptivity in the latter. Having

learned a list of nonsense syllables and a list of words, the subject was occupied for 25 minutes in the accuracy of decision test described above; and then asked to write down first all the nonsense syllables and then all the words he still remembered. His memory for a period of 25 minutes was thus measured by the number of words and syllables he still remembered. A test of memory for figures, for words, and for nonsense syllables was given each subject every week for three weeks; and the average efficiency for the three tests taken as the measure of the subject's memory ability for each kind of material.

We shall first consider the memory span as measured by the number of digits reproduced immediately after two repetitions. Every subject showed improvement with practice in this test; and some were able to reproduce one figure more at each test than at the last; but only the averages for the three tests are given in Table XXIX. These results partly verify our conclusion regarding memory span in the last investigation. As before, there is no correlation between memory span and decision time for either kind of decision; but there seems to be a correlation, not so marked as before, between memory span and constancy,—for the most inconstant have poor memory spans. Moreover, there is here shown a considerable correlation between accuracy of decision and memory span. There is probably only one exception (subject R), and this would mean a correlation coefficient of .9 or over. We have observed above that there is probably a correlation between suggestibility and inaccuracy. If this is so, then suggestibility, inaccuracy, and poor memory span ought to go together. The fact that the four most positively suggestible subjects have also the poorest memory spans affords some confirmation of this supposition. Since memory span for figures is closely related to span of attention, and a broad span of attention means the ability to take in all the details of a situation, which is essential to correct evaluation and decision, we would naturally expect this correlation between memory span and accuracy of decision. The accuracy spoken of here, as elsewhere in the discussion of memory, is for the comparison of the number of holes in pairs of cards, and not for the situation test. The results

for the latter show less evidence of correlation with memory in every instance.

TABLE XXIX

Subject	*M.S.*	*C.*	*A.*
L	11⅓	35	35
C	11	21	35
S	10	39	30
M	9⅔	30	36
N	9⅓	37	52
A	9⅓	21	37
Q	9	43	42
P	9	32	43
R	9	43	35
O	8	29	37

M.S. = Memory span for figures.
C. = Constancy, number of changes in 50 aesthetic decisions.
A. = Accuracy, number of errors in 100 decisions.

The immediate memory or learning ability of the subjects, as measured by the number of repetitions required to memorize the lists, is shown in Table XXX. The average number of repetitions for three lists of twelve nonsense syllables each, and for three lists of eighteen words each is given for each subject; and then these figures are added to get an idex of learning ability. The number of repetitions for words and those for nonsense syllables correspond, on the whole, pretty well. The largest figures for each are in the lower halves of the columns; but there are some important variations. Some of the subjects were accustomed to work with nonsense syllables, and, therefore, had some slight advantage; these are marked with an asterisk. No correlation is brought out between learning ability and decision time, constancy or accuracy, except in the case of repetition for words taken alone. Here a slight correlation between quick learning and accuracy is shown, but subject N is a marked exception—very inaccurate, yet learning very quickly. The correlation mentioned is important, for in this test the subjects were told to make use of artificial association to aid them in learning. It means, therefore, that rapidity in the formation of associations is correlated with accuracy, while mere receptivity, as tested by nonsense syllables, is not; and this is a similar correlation to that brought out in the

association test where it was found that quickness of association time was correlated with accuracy of decision. There is, therefore, no doubt that the speed and certainty of association is an important factor in assuring accuracy in decision. Learning ability for nonsense syllables is not at all correlated with memory span for figures; but, as expected from their mutual correlation with accuracy, the learning of words is. There are only two cases of unlike deviation (signs): subjects C and R, the former good in memory span and poor in learning,—the latter the opposite.

TABLE XXX

Subject	*L.*	*W.*	*N.*	*E.A.*
R	13⅓	5⅔	7⅔	35
*N	16	7	9	52
*O	16⅔	10	6⅔	37
M	17⅓	6⅔	10⅔	36
*L	18⅔	7⅔	11	35
P	19⅔	9	10⅔	43
S	24⅔	8⅓	16⅓	30
*A	26⅔	11⅓	15⅓	37
C	28⅓	13⅔	14⅔	35
Q	32	16	16	43

W. = Number of repetitions for lists of eighteen words.
N. = Number of repetitions for lists of twelve nonsense syllables.
L. = Learning ability, obtained by adding the two above.
E.A. = Errors in accuracy of decision test for comparison with column W.
* = Subjects who had previous experience with nonsense syllables.

The memory of the subjects was also measured by the number of words and syllables remembered after a period of twenty-five minutes. The results (given in Table XXXI) flatly contradict the correlation noticed in the last investigation between memory over a period of one week and rapidity of decision. There it was observed that the subjects quick in decision had better memories than the slow. Here, on the contrary, the slow subjects have, with only one exception, better memories than the quick. Of course, both results may be true since one experiment was on memory for a week and the other on memory for twenty-five minutes; and a subject who remembers well for twenty-five minutes may not remember relatively as well for a week.

As before, no definite correlation is brought out between

memory and constancy or accuracy. The two subjects, however, who have the best memory for words (L and S) are also accurate subjects. We would expect from previous considerations that strength of association (memory for words) would show some correlation with accuracy, and that retentiveness, as tested by memory for nonsense syllables, would not. We would expect also that memory for words would correspond pretty well with memory span for figures; and this is true, with the exception of subject C, who is very good in the latter and very poor in the former.

In tests for memory it is very difficult to keep the conditions the same for all subjects, especially where, as in this case, the subjective interests of the subjects are not the same. Each subject does best in the test in which he is most interested or likes best. This is true of any test; but it is probably not so serious an objection as might be supposed for the interest may follow the ability instead of the reverse as is usually supposed. Objective conditions were always kept as near as possible the same. The subjects were asked not to think of the material learned during the 25-minute interval, in which they were occupied, as stated above, in the accuracy of decision test. In the first test they did not know they were going to be asked to write what they could remember after 25 minutes; and, as the results show that they did as well in it as afterwards, we conclude that they succeeded in following the instructions in the second and third tests.

TABLE XXXI

Subject	*W.*	*N.*
L	18	10⅔
S	18	9⅔
N	17	9⅓
M	17	9⅓
P	15⅔	9⅓
A	15⅔	8⅓
R	15⅓	8
Q	15⅓	7
O	14⅔	6
C	9	3

W. = Number remembered out of eighteen words after 25′.
N. = Number remembered out of twelve nonsense syllables after 25′.

ATTENTION

The relation of attention to decision time, constancy and accuracy is probably of more importance than any of the relations so far considered; but there are as yet no adequate tests for attention and the work on this point is therefore even more meager than on the others. *Span* of attention is probably fairly well tested by the work on memory span for figures. Two other tests were now made: the cancellation test (A-Test) for *duration* of attention, and the dot-counting test for concentration of attention.[7] Both of these tests involve other factors as well as attention; but there can probably never be a test for attention alone; for attention means attention to something and therefore involves at least sensory and perceptual factors.

The A-Test is chiefly a test of visual perception and recognition. It, of course, requires attention, but the results are ambiguous. A poor showing may be due to defects of perception or slow reaction rather than poor attention. Each subject was given only one test. A page containing thirty lines of pied text was used. There were 51 A's to be cancelled. Efficiency was measured by the time taken to perform the task and the number of errors. Whipple gives the formula $A = \frac{C - W}{C + O}$ to compute the index of accuracy.[8] C = the number of letters crossed; W = the number wrongly crossed; and O = the number erroneously omitted. Since none of the ten subjects had any of the W class, the number of letters crossed out of 51 can always be taken as the index of accuracy. Also, to compute a single index of efficiency, Whipple gives the formula $E = \frac{S}{A}$, in which E = the desired efficiency, S = the time, and A = the accuracy index; but, since the accuracy varied so little and the time so much, the efficiency as computed by this formula corresponds exactly to the time, which we have therefore used in our statement of the results in Table XXXII.

[7] For description of these tests see Whipple's Manual, pp. 254-273.
[8] Ibid. pp. 260-261.

TABLE XXXII

Subject	*Time*	*A.*	*S.T.*
L	110″	47	1661
P	131	50	2646
M	136	51	2040
A	160	51	2300
Q	162	50	1890
S	172	51	2440
O	177	51	2130
C	191	49	2190
N	227	50	3300
R	252	47	2814

A. = Number cancelled out of fifty-one.
S. T. = Products in the situation test.

These results show no relation to time, constancy or accuracy in the decision experiments, but they correspond fairly well with the products in the situation test. This is probably because in both tests the perception and recognition of letters are important factors. There is probably also, as in the situation test, some relation to suggestibility; for the mistakes are all made by suggestible or contra-suggestible subjects.

The dot-counting test also involves other factors than attention; and these are, according to the introspection of the subjects, chiefly visual schematism or ingenuity in grouping the dots and immediate memory for these groups. Each subject was given two tests; in the first there were 50 dots, in the second 57. The errors were counted by taking the difference between the given and the true numbers. The total errors and the average time for the two tests are given for each subject in Table XXXIII. The O or U signifies that the mistakes were made in over- or under-estimating the true number. There seems to be no correspondence between time for dot-counting and time for the cancellation test. In fact, the quickest in the latter was the slowest in the former; but there is not a general inverse relation. There is also no relation brought out between the results for the dot-counting test and time, constancy, or accuracy in the decision test; nor is there any relation, as in cancellation, to the situation test. On the whole, however, the least suggestible subjects are the quickest in dot-counting, though not always the most accurate.

These tests may probably have been successful in showing the

relation of the factors tested to decision type; but it seems to us that attention was not the most important of these factors, and that the results cannot be considered as any indication of the relation of attention to decision. In all probability attention is a much more significant and crucial factor at least in accuracy than these results would show; and its real place is more likely better revealed by the tests for memory span.

TABLE XXXIII

Subject	*Time*	*E.*
S	16.5′	1—O
M	20.0	3—U
A	21.0	5—U
N	22.0	2—U
O	25.5	1—U
R	36.5	7—U
Q	37.0	1—U
P	53.5	1—O
C	63.5	1—U
L	78.0	2—O

E. = Errors for two tests.
O. = Over-estimations.
U. = Under-estimations.

ORIGINALITY TEST

The last test we have to report had for its object to bring out the originality or inventiveness of the subjects. The following method, suggested by a paper of Professor Royce's on the "Psychology of Invention,"[9] was adopted: First a circle was presented to the subject, who was told to draw another geometrical figure as different as possible from this; then a rhombus with diagonal was presented and the subject asked to draw *anything else,* as different as possible; and finally five concepts were given one at a time and the subject was to write other concepts as different as possible from these. The degree of originality is shown by the ability to break away from the impressions or ideas, and by the time of the performance. The tendency in the first test would be to draw a square, in the second to draw some other geometrical figure, and in the third to write the opposite of the given concepts, which were: mind, cause, substance, man, and heaven. If this tendency were followed out, it would indicate a

[9] Psych. Rev., Vol. V, 1898, pp. 113-144.

routine mind, incapable of breaking away from the dominance of the ideas and impressions borne in upon it; while the further it were departed from, the greater the degree of originality. Since the ordinary associations of these perceptions and concepts may not be exactly the same for every subject, as the ones mentioned above, it was necessary to take the introspection of the subjects into consideration in estimating the amount of departure from the ordinary. Of course, this estimation was no doubt also influenced by the subjective prejudices of the experimenter; but Table XXXIV gives the relative standing of the subjects as near as it could be estimated from the records. The subjects are arranged in order of originality with the most original first.

TABLE XXXIV

Subject	*O.*	*Time*
L	16	228″
S	15	43
A	11	107
N	10	84
M	10	61
C	10	64
O	10	60
P	8	56
Q	4	87
R	2	48

O. = Index of originality.
Time = Total for all the tests.

The originality index was calculated in the following way: a complete departure from the above-mentioned ordinary tendency, shown by both the introspection and the objective records, was in Tests 1 and 2 valued at 5; a complete submission to it at 0; and various degrees of success at overcoming it were represented by values from 0 to 5. In Test 3, thorough success in getting away from the usual ideas was valued at 10, 2 for each concept. The figures given in column "O" of the table are, therefore, the values attained out of a possible 20. In general, those who were original with the impressions in Tests 1 and 2 were also original with the ideas in Test 3; and we, therefore, give only the total for all tests in the table. The same can be said of the time, and for the same reason only the total time for the three tests is given.

As we anticipated, the results in this test are inversely related to the results previously obtained for suggestibility. The most original are the least suggestible; next in order come those who are also contra-suggestible; and least of all the positively suggestible. There is only one exception to this: Subject L, who has shown the greatest originality, is both positively and negatively suggestible in the decision test; but his originality was only attained by the sacrifice of a great deal of time; while S, the least suggestible subject, is both quick and original in this test. Of course, we might follow our method in the decision test, and say that there are both quick and slow original, and quick and slow non-original types; for it is hardly fair to say that difficulty in overcoming the tendency, as shown by a lengthening of the time, if rewarded by final success, indicates a lack of originality. It is surely one type of originality—the originality of the thoughtful, persevering man as distinguished from that of the genius. This difficulty, however, shows some suggestibility, and if the test is taken merely as a test for suggestibility, the lengthening of the time must certainly be taken into consideration as a mark of that trait, for it appears that a suggestible person may be original but cannot be quick in his originality. If the time as well as the work done is thus evaluated, this test for originality becomes truly a very good test for suggestibility. The suggestible subject will succumb to the suggestion of the ordinary association with the idea or impression given, or will take *a very long time* to overcome it; while the non-suggestible will quickly break away from it.

Other correlations with originality are just the inverse of those previously noticed with suggestibility. Hence, the most original subjects are the most accurate in the comparison test and have the fewest mistakes in the situation test. This correlation is strengthened by subject L's position at the head of the list in the originality test.

All the tests given were very successful in bringing out large individual differences; but too few subjects were examined to obtain any adequate information regarding the correlation of the various traits. Several correlations have been hinted at; but the

results in this respect were largely negative. It may be that on further investigation with a larger number of subjects correlations may be obtained where we have found none; and those we have suggested may be proved erroneous; but until refuted by more efficient investigations, we shall assume that these results point in the right direction. They seem to verify two important statements made by Thorndike[10]: (1) that the variations in mental traits are continuous and cluster around one central tendency or type; and (2) that in mental traits correlation and not compensation is the rule,—that is to say, efficiency in one trait is very likely though not certain to be correlated with efficiency and not deficiency in another.

[10] Educational Psychology, 1910, chapter X.

CONCLUSIONS

The very nature of the investigation renders this paper extremely difficult to summarize; but we shall endeavor to select from the results scattered throughout a few conclusions that may be regarded as of chief importance.

(1) There is no correlation between time and constancy in either logical or aesthetic decisions. Hence, we are able to speak of four decision types: quick constant, slow constant, quick inconstant, and slow inconstant. These types, however, grade into each other, so that there is no natural dividing lines between quick and slow, and between constant and inconstant.

(2) There is no correlation between time and *accuracy* in objective decisions, so that here also any time can be combined with any degree of accuracy. This fact has some practical significance; for it shows that subjects both quick and accurate exist. They are, however, probably rarer than the mediocre in time and accuracy, and their rarity no doubt increases with their efficiency.

(3) There is no correlation between time in subjective and time in objective decision, nor between constancy in the former and accuracy in the latter. That is to say, the consistent subject may be consistently inaccurate; and the subject slow in matters of taste or opinion may be quick in objective situations. There seems, however, to be some evidence of a correlation between quickness in subjective decisions and accuracy in objective,—a correlation probably based upon the concentration of attention required in both traits; but it is not sufficiently marked to warrant serious discussion.

(4) Some subjects who come under the quick constant class in simple decisions, change their type under more complex conditions, becoming slow or inconstant or both. If this change of type also occurs for time and accuracy in objective decisions (and the results for the comparison and situation tests seem to show that it does), the fact is of considerable importance; for the individual thus changing would be successful in vocations requiring simple

acts of decision, but would fail in any calling that demanded decisions in relatively complex situations.

(5) Subjects differ greatly in the variability of their decision times; so that there are "uniform" and "variable" subjects; but the variability in the decision times of any given subject has no relation to his variability from the mean average time for all the subjects. Hence, subjects can be found who are both much quicker than the average and also "uniform." The subjects "variable" in time are as a rule the same ones that change their type under more complex conditions. The coefficient of variability is greater in objective than in aesthetic decisions, and there is no correlation between the C.V.'s in the two tests. The C.V. is an independent factor, not correlated with time, constancy, or accuracy in decision.

(6) In general, practice has no marked effect upon decision times; but there are individual differences in this respect—some of the more adaptable subjects quicken the time.

(7) The decision time for the second presentation is, as a rule, less than for the first; but for some subjects it is relatively very much less than for others. These subjects probably learn very quickly from experience, and their efficiency increases rapidly with repetition; but their efficiency in novel situations as shown by the time for the first presentation is not altered. This is important practically; for such subjects would be successful in an occupation presenting very few situations with routine decisions in each, but might fail in any vocation which demands quick decisions upon always novel situations.

(8) In subjective decisions the confident subject is more apt to be constant than the inconfident; but in objective decisions the confident subject is not more liable to be correct. In the latter the medium subject has the greatest accuracy, while the over-confident and under-confident are both inaccurate. The over-confident, however, varies little in his confidence from right to wrong judgments, while the under-confident are much more confident for their correct than for their incorrect decisions. In both subjective and objective decisions the confident judgment of any given subject is more apt to be constant and accurate respectively than

his inconfident judgment; but the difference is less than might be expected.

(9) In subjective decisions there was more inconstancy with judgments which the subjects described as difficult. The same thing is shown by the fact that there were more changes in decisions where times were above the median, and hence more difficult, than in those below it.

(10) The subjects differ relatively in constancy with the different materials used in the aesthetic decisions. On the whole, there are most changes with the post cards and least with the pictures. They also differ in respect to the material which they find most difficult to decide upon. This is shown by their relative differences in *time* with the different materials.

(11) The accuracy of the objective decisions remained on the whole about the same when the time was allotted. Of the slow subjects, some were more inaccurate when hurried, while others actually did better; and the longer time did not increase the accuracy of the quick subjects. These facts may favor the theory of an "optimal judgment time"; or it may be that the slow who were more accurate when hurried belong to that class of individuals who, while quite phlegmatic in ordinary life, excel when called upon to fill an emergency.

(12) The general effects of suggestion upon decisions are to lengthen the time and increase the inconstancy; but these effects are much more pronounced with some subjects than with others. The suggestion also reduces the variability of the subjects from their central tendency in time and increases it in the number of changes.

(13) Subjects can be roughly classified into four types on the basis of their suggestibility: (1) the non-suggestible, (2) the positively suggestible, (3) the positively and negatively suggestible, and (4) the negatively suggestible. These types merely signify certain degrees of the trait; for there is probably no absolutely non-suggestible subject, just as there is no purely positively or purely negatively suggestible person.

(14) There is a correlation between suggestibility and accuracy. The less the suggestibility, the greater the probability of

accuracy. This is shown by the number of errors in the comparison test, as well as by the number of mistakes in the "situation test."

(15) The results for the "comparison test" and the "*situation* test" are by no means identical. The latter presents a more complex situation; and subjects who are equally excellent in simple decisions may be quite different in more complex ones.

(16) The situation test seems to be successful in bringing out the mental trait intended; but the method of evaluating the results and comparing the subjects requires further study and correction.

(17) The best material for testing suggestibility appears to be geometrical figures; for here the suggestion was most readily accepted. The post cards were the poorest material for bringing out suggestibility, but the best for contra-suggestibility. There were, however, marked individual differences as to the material which brought out the most or least of these traits.

(18) The suggestible subject *may* or may not be introspectively aware of his suggestibility. He may think his decision is unbiased or even remember that he decided the same way before, while his memory plays him false and he is really accepting the suggestion.

(19) Inertia, or the tendency to leave things as they are, exerts some influence on decision. This inertia is much greater with some subjects than with others. There is also some indication of its correlation with *variability* in time.

(20) Position also influences decision. This influence is one kind of suggestion, and of course varies in amount with different subjects. There is also considerable variation in the position that is found most attractive. Position B,—that is, one from the right, is the most favored.

(21) Association time shows some slight correlation with time in aesthetic decision; and also with *accuracy* in objective decision; in that the quickest in association time are the more accurate.

(22) In conformity with the above, we find that there is a correlation between rapidity of learning lists of words and accuracy; but not between the learning of nonsense syllables and accuracy. In the former, association is the chief factor; while in

the latter, receptivity or plasticity is a more important factor than association.

(23) Memory span for figures is also well correlated with accuracy and very slightly with constancy. It is also correlated with suggestibility,—the most suggestible having the poorest memory spans.

(24) Memory over periods of time, and time for sorting cards show no definite correlation to decision time, constancy, or accuracy.

(25) The results of the A-test are correlated fairly well with the products in the situation test; but neither the A-test nor the dot-counting test brought out any correlation with decision time, constancy, or accuracy. The least suggestible, however, make the fewest mistakes in the A-test; and are also the quickest, though not the most accurate, in the dot-counting test.

(26) The most original subjects are the least suggestible; but a suggestible person may be original, if he has the perseverance and will to overcome the suggestion; and this probably requires some contra-suggestibility.

(27) The most original subjects are the most accurate in the comparison test, and have the fewest errors in the situation test.